NASA CR-132673

Handbook December 1974

Nonmetallic Materials

(NASA-CR-132673) NONMETALLIC MATERIALS HANDBOOK (Martin Marietta Corp.) 304 p HC $9.25 CSCL 11C

N75-28229

Unclas
G3/27 29074

Issued by
National Aeronautics and Space Administration
Langley Research Center
Hampton, Virginia

Prepared under Contract NAS1-13177 by
Martin Marietta Corporation
Denver Division
Denver, Colorado 80201

MARTIN MARIETTA

FOREWORD

This document was prepared by Martin Marietta Corporation, Denver Division under contract NAS1-13177, "Non-Metallic Materials Handbook". The sponsor for this activity was the National Aeronautics and Space Administration's Langley Research Center with Mr. Robert Magee, of the Viking Project Office, acting as Technical Monitor.

The program was conducted in the Materials Section with Mr. S. Podlaseck serving as Program Manager and Dr. H. Papazian the Principal Investigator.

Significant contributions were made to the final document by Mr. T. Krol, who was responsible for much of the data gathering and reduction as well as assembly of the final document.

This report has been reviewed and approved.

Table of Contents

TESTS

1.	Vacuum TGA	V70/23P
2.	Mass spectra of volatiles	V70/23P
3.	Nitrogen TGA	V70/23P
4.	DTA	V70/23P
5.	Isothermal weight loss in nitrogen	V70/22P
6.	Vacuum condensables	V70/22P
7.	Corona resistance	ASTM D1868
8.	Dielectric strength	ASTM D149
9.	Dielectric constant	ASTM D150; ASTM 1673
10.	Dissipation factor	ASTM D150
11.	Insulation resistance	ASTM D257
12.	Surface and volume resistivity	ASTM D257
13.	Adhesion	FTMS 141 Method 6304.1
14.	Bearing strength	FTMS 406 Method 1051
15.	Bend test	FTMS 141 Method 6304.1
16.	Compression set	ASTM D395
17.	Compression strength	ASTM D695; ASTM 1621; ASTM C165
18.	Creep	ASTM D674
19.	Dimensional stability	ASTM C548; ASTM C356
20.	Emissivity and absorptivity	V71/96P; V71/97P
21.	Flexibility	FTMS 141 Method 6221
22.	Flexure	ASTM D790
23.	Hardness	FTMS 601 Method 3021 ASTM D785 and D2240
24.	Lap Shear	ASTM D1002
25.	Moisture resistance	ASTM D570
26.	Peel	ASTM D1876
27.	Knot breaking strength	(MMC) STM F420
28.	Scratch	FTMS 141 Method 6304.1
29.	Solvent resistance	ASTM D471
30.	Specific gravity	ASTM D792

Tests (Cont'd)

31.	Tear	ASMT D624
32.	Tensile	ASTM D412; ASTM D638 FTMS 191 Method 4102
33.	Thermal conductivity	ASTM C177
34.	Thermal expansion	ASTM D696
35.	Water absorption	FTMS 406 Method 7031

Material Test Index

NAME	TESTS PERFORMED*																																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Dacron																																			
Dacron Fabric Tape	X	X	X	X	X	X																										X			
Epoxy																																			
Ablefilm 501-1	X	X			X																														
Ablefilm 517	X																																		
C7-4248	X	X			X	X																													
EA934 Adhesive	X	X	X	X	X	X																		X											
EA 956	X	X																																	
EC 2216 Adhesive	X	X	X	X	X	X																		X											
EG 818T Laminate	X	X																																	
Epocast 203	X	X			X																														
Epon 828/MPDA/120 Fiberglass Cloth	X	X																																	
Epo-Tek H72	X	X																																	
Epo-Tek 417	X	X																																	
ES-222	X	X																																	
FM-40	X	X			X																														
M-9-N/Catalyst A	X	X																																	
MF500F-124 Microwave Absorber	X	X			X																														
Stycast 1263/Cat.31	X	X																																	
Stycast 1090/Cat.11	X	X	X	X	X	X			X																										
Stycast 2850 FT/ Cat.9	X	X	X	X	X	X																													
Stycast 2850 FT/ Cat.11	X	X	X	X	X	X			X																										

*Numbers refer to tests listed on pages iv and v.

Material Test Index

NAME	TESTS PERFORMED* 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Trucast 111M/901	X	X																																	
Trucast 111M/902	X	X																																	
Epoxy Phenolic																																			
HT424 Adhesive Film	X	X	X	X	X	X																		X											
Fluorocarbons																																			
Aclar Film	X	X																																	
Tedlar	X	X																																	
Viton A, Parker Compd, V747-75	X	X			X	X										X																			
Viton A, Parker Compd, 77-545	X	X			X	X										X																			
Viton A, Parker Compd Mil-R-25897E Type 2 Class 1	X	X	X	X	X	X																													
Nylon																																			
Nomex Thread Mil-T-43636	X	X																																	
Vel-Cro Pile Mil-F-21840C Class 2	X	X			X																														
Phenolic																																			
Adlock 851	X	X	X	X		X																X										X			
F502/A120 Prepreg	X	X																																	

*Numbers refer to tests listed on pages iv and v.

Material Test Index

NAME	TESTS PERFORMED*																																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Polyimide																																			
Kapton H Film	X	X	X	X		X																													
Polyimide (Porous)	X	X																																	
Polythermaleze Wire Insulation	X	X			X	X																													
TR150-25	X	X																																	
Vespel SP-1	X	X	X	X	X	X		X	X	X		X										X	X									X			
#92 Tape	X	X			X																														
Polyurethane																																			
CPR 17-2C	X	X																																	
Eccofoam FPH/12-6H	X	X	X	X	X	X			X								X																		
Solithane 113/C113-300	X	X	X	X	X	X		X	X		X	X											X	X											
Silicone																																			
Cho-Seal 1224	X	X	X	X	X	X						X				X							X						X			X			
DC6-1102	X	X			X	X																													
DC6-1104	X	X			X																														
DC6-1106	X	X	X	X	X	X																													
DC92-007	X	X	X	X	X	X														X															
DC93-500	X	X	X	X	X	X		X	X																										
MS40G08	X	X			X	X																													
Silicone Tape, Series 600	X	X																		X															
RTV-511, Modified	X	X	X	X	X	X																													
ZP 5044 Silicone Gasket	X	X				X																													

*Numbers refer to tests listed on pages vi and v.

Material Test Index

NAME	TESTS PERFORMED*																																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Teflon																																			
Teflon Lacing Tape	X	X	X	X	X	X																					X					X			
Teflon Sheet TFE Mil-P-22241	X	X			X																														
Teflon Tubing FEP	X	X			X																														
Miscellaneous																																			
Diall FS-80, Black Mil-P-19833, Type GOI-30	X	X			X				X	X		X										X													
LubeLok 4306	X	X			X	X																													
Min-K-2000	X	X	X	X	X	X											X		X														X		
P292 Tape	X	X																																	
Parylene C	X	X			X																														
Vac Kote Type II	X	X			X	X																													
M-9-N/Cat. A	X	X																																	

*Numbers refer to tests listed on pages iv and v.

APPLICATION INDEX

APPLICATION INDEX (Concluded)

INTRODUCTION

This handbook is a compilation of chemical and physical property test data obtained during qualification and receiving inspection testing of nonmetallic materials for the Viking Mars Lander (NAS1-9000) program at the Denver Division of Martin Marietta Corporation. The compilation presented here is unique in that all tests have been carried out by one group of test personnel. This familiarity with all test procedures and materials minimizes the possibility of unintentional modifications of test techniques and misinterpretation of data and their presentation.

This document contains data on the following types of materials: sealants, potting compounds, lubricants, paints and finishes, inks, films, fabrics, encapsulants, elastomers, structural plastics, ablatives, adhesives, and electrical and thermal insulators.

The information presented has, as a minimum, thermochemical data showing degradation as a function of temperature from room temperature through 500°C. These data include activation energies for thermal degradation, rate constants, and exo- and/or endotherms. Thermal degradations carried out under vacuum include mass spectral data taken simultaneously during the decomposition. Many materials have supporting data such as condensation rates of degassed products and isothermal weight loss. Changes in mechanical, electrical and thermal properties after exposure to 135°C in nitrogen for times ranging from 380 to 570 hours are included for many materials.

Over 400 organic/polymeric materials were considered for use throughout the Viking Mars lander capsule program. Considering the variety of mechanical, electrical and thermal property measurements required, conventional vacuum tests techniques would be

prohibitive from the standpoint of both cost and schedule. Unique facilities for determining physical properties in-situ were developed to handle the environmental exposure and material qualification test requirements established for the Viking Mars lander capsule. Since the capsule is almost completely inactive during cruise from Earth to Mars and few mechanical or electrical stresses are developed during this phase, the thermal vacuum environment is the only simulation required. The system developed separated the environmental conditioning from testing and provided for transfer of specimens between conditioning and testing chambers without exposure to atmosphere. It is described later.

DISCUSSION OF TEST METHODS

I. Thermochemical Data

A. TGA: Thermogravimetric analysis (TGA) is the continuous weighing of a sample while it is being heated at a fixed heating rate, e.g., 10°C/min. During this process, the sample loses weight continuously, beginning and ending at temperatures peculiar to the sample material. Figure 1 is a schematic of the system used.

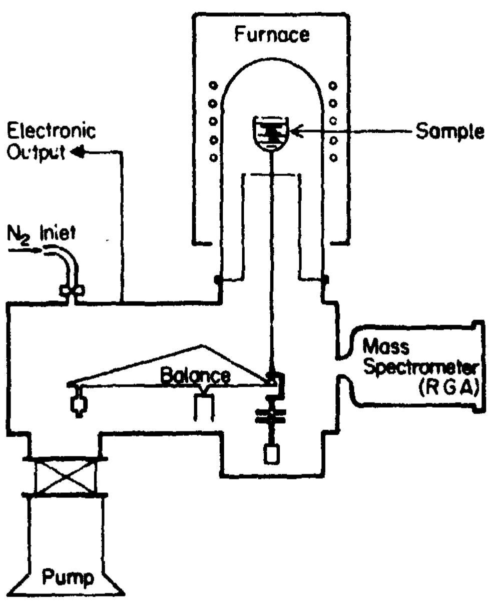


Figure 1
Schematic of TGA-RGA Apparatus

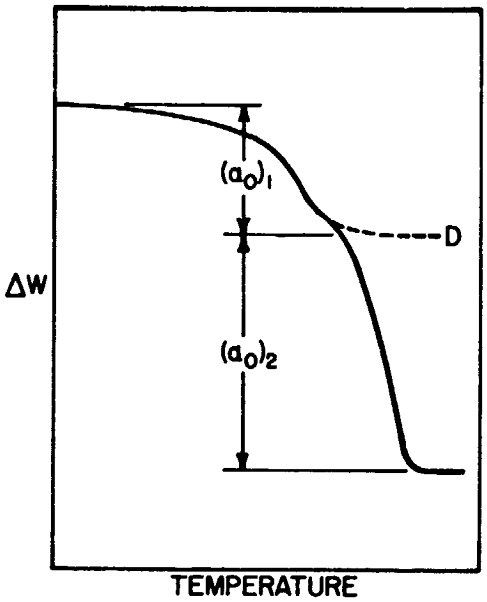


Figure 2
TGA Curve for a Silicone

Figure 2 shows the TGA curve for a silicone. This material thermally decomposes in a two-step process; the dotted line depicts the end of the first reaction. The second reaction may be the decomposition of the product of the first reaction or it may be different component of the original material.

The simple first-order kinetic equation

$$\frac{dx}{dt} = \frac{k_T}{(a_o - x)} \qquad (1)$$

has been found to be adequate for describing the decompositions. In this equation, k_T is the rate constant at temperature T, dx/dt is the rate of weight loss, x is the weight loss, and a_o is the initial amount of the "active component." The active component is that portion of the original weight of the sample that participates in decomposition. For decompositions with a simple TGA curve, the active component is taken as the total weight loss. For polymers where the TGA shows the degradation to be more than a one-step decomposition as in Figure 1, the initial weight of the active component a_o is taken as that portion of sample weight participating in the step. In Figure 2, these are designated as $(a_o)_1$ for the first decomposition and $(a_o)_2$ for the second step. In utilizing equation (1), the thermoanalyzer yields dx/dt from the DTG output, which is the electronically determined slope of the TGA, x is obtained from the TGA curve, and a_o as described.

The rate constant is given by the "Arrhenius relationship"

$$k = A \exp\left(\frac{-\Delta E}{RT}\right) \text{ time}^{-1} \qquad (2)$$

where A is a constant, usually called the frequency factor, R is the universal gas constant, T the absolute temperature, and ΔE is and energy term known as the activation energy of the process. If the rate constants, experimentally determined at several temperatures, from Equation (1) are plotted against the reciprocal of absolute temperature (°K), the result is the Arrhenius relationship depicted in Figure 3. The slope of this plot yields the activation energy of the decomposition.

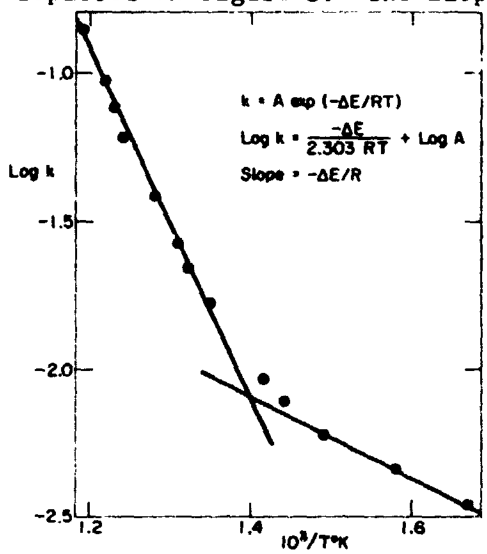


Figure 3
Arrhenius Relationship Obtained from TGA Curve

Figure 3 shows the results obtained for the first reaction step of the decomposition for the silicone depicted in Figure 2. The points on the plot are representative of the very large number of data points available from the TGA-DTG output of the thermoanalyzer. The larger slope is the activation energy for the decomposition of the polymer associated with $(a_o)_1$. The smaller slope results from degassing of "solvent" such as unreacted monomer, catalyst, etc. At the lower temperatures of the TGA test where this slope appears, x in Equation (1) is predominantly "solvent" loss whereas the amount of "solvent" is so small with respect to the amount of polymer that it does not affect a_o for the polymer degradation. Thus, when the "solvent" is degassed during the early stages of the TGA test, the Arrhenius relationship reverts to that for the degradation of the polymer itself.

Integration of the rate equation, Equation (1), yields

$$a_o - x = a_o e^{-kt} \qquad (3)$$

where t is time. Then

$$\frac{a_o - x}{a_o} = e^{-kt} \text{ is the fraction remaining.} \qquad (4)$$

Thus, when k is determined for a particular temperature, one can get the fraction of material remaining after a time, t,

$$1 - e^{-kt} \times 100 = \%\ \text{weight loss.} \qquad (5)$$

As an example consider the question, what is the time required for a 1% weight loss at 150°C (423°K) for a silicone such as that depicted in Figure 2? From information given for the material in the Data Section we find that

$$k_T = 0.8 \exp\left(\frac{-6720}{kT°K}\right) \text{min}^{-1}$$

Therefore

$$k_{150°C} = 0.8 \exp\left(\frac{-6720}{1.98x423}\right) = 2.63 \times 10^{-4}\ \text{min}^{-1}.$$

For 1% weight loss, the fraction remaining is 0.99 so $e^{-kt} = 0.99$, from which we find that $kt = 0.01$. Thus the time required is

$$t = \frac{0.01}{2.63x10^{-4}} = 38\ \text{min} = 2.3 \times 10^3\ \text{s}.$$

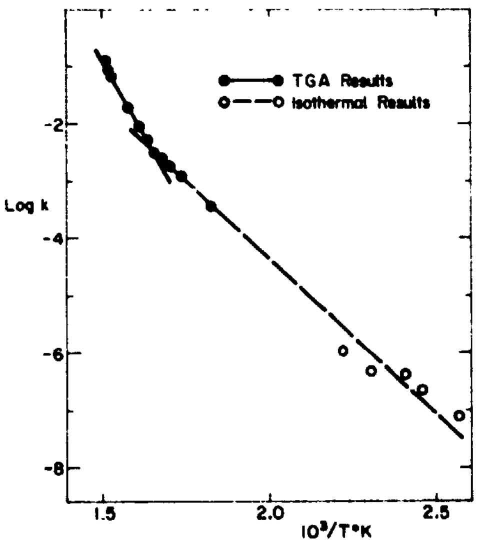


Figure 4
Arrhenius Relationship Comparing TGA and Isothermal Results for Dacron

Figure 4 compares TGA results on approximately 10 mg of Dacron parachute material with an isothermal decomposition on approximately 4 gm of material at near normal use temperatures. The excellent agreement with the prediction of TGA is evident. It should be noted that the TGA is able to predict rate constants at some 300°C lower temperature on realistically sized samples. Predictive capability has been found for all materials so compared (see "Prediction of Polymer Degradation Kinetics at Moderate Temperatures from TGA Measurements," H. Papazian, *J. Appl. Polym. Sci.*, 16, 2503, 1972).

When the cure and postcure of two different batches of the same polymer are carried out in the same manner, the TGA curves are identical.

TGA tests were run at heating rates of 10°C/min for both the vacuum and nitrogen tests. Samples were prepared as small particles scraped or cut to size to approximately 10 mg of total weight. Samples were preconditioned prior to TGA tests in several ways and are discussed for each material in the results section. For the nitrogen TGA tests, the flow rate for the nitrogen was 5.2 l/hr. During vacuum TGA tests, mass spectra were taken at 1-minute intervals (i.e., every 10°C).

The TGA data in this document are presented in graphical form, similar to Figure 1, giving weight loss vs temperature from ambient to 500°C. A second curve having 10 times the sensitivity of the standard TGA curve is used to give an accurate display of the first 10% of weight loss. This will give details of the early portion of the decomposition, which may be of importance in determining low temperature degassing, water absorption, etc.

The TGA curves obtained under vacuum will have, in most cases, the associated pressure rises in the system during decomposition as well as the mass spectra of the volatilized material.

B. Mass Spectra - Mass spectrometry, sometimes referred to as residual gas analysis (RGA) or evolved gas analysis (EGA), has been used to qualitatively characterize the volatile species as they are generated during the TGA test.

When a volatilized molecule enters the ionization chamber (or region) of a mass spectrometer, is is impacted by energetic (70-eV) electrons. The molecule is thereby fragmented into its mass spectrum. This mass spectrum is characterized by masses and their intensities. For example, H_2O is fragmented into masses 18 (H_2O^+), 17 (OH^+), 16 (O^+) in the intensity ratio 18 = 100, 17 = 26, 16 = 6. Whenever a mass spectrum is observed with the masses 18, 17, and 16 in the intensity ratio 100, 26, and 6, it may be identified as

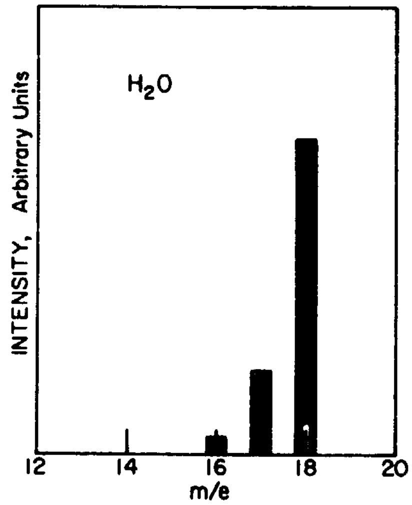


Figure 5
Mass Spectrum of Water

water. Figure 5 depicts the mass spectrum of H_2O obtained with 70-eV electrons. The abscissa is labeled m/e to be consistent with the usual presentations. The ratio of mass-to-charge, m/e, is what is actually measured in the mass spectrometer. Since it is unusual for the charge e to be equal to 2, the m/e ratio is usually the mass number or mass fragment. For simple molecules the analysis is quite simple. With increasing molecular weight and therefore increasing complexity of the molecule, the complexity increases accordingly. In mixtures of such molecules, as are present in most polymeric systems, the analysis is exceedingly difficult. However, mass spectra used in conjunction with TGA data permit determination as to whether samples from two different batches are identical. This permits comparison of materials and how they were processed.

Mass spectra can also be useful in determining degassing prior to thermal decomposition. For example, one can determine how much H_2O, solvent, unreacted monomer, etc remain in the material after processing, e.g., cure, postcure.

On all TGA tests under vacuum, mass spectra are taken at 1-minute intervals, i.e., every 10°C. Since it is impractical to present these voluminous data, approximately seven temperatures are chosen along important parts of the TGA curve and mass spectra at these temperatures are presented in tabular form.

C. DTA: Differential thermal analysis (DTA) indicates the heat changes taking place during the decomposition. An exotherm indicates a release of heat, and an endotherm indicates the absorption of heat. This information is useful in determining the mechanism of the decomposition reaction.

DTA curves are obtained simultaneously with TGA under nitrogen and are presented in graphical form for each material.

D. Isothermal Weight Loss in Nitrogen: The purpose of this test was to simulate the Viking lander sterilization conditions.

Samples were preconditioned for 24 hours at 23°C (296°K) in 45% RH for a baseline condition. Approximately 2 to 5 gm of sample was weighed and placed in a gastight system at 135°C (408°K). Nitrogen flowing at 5.2 ℓ/hr was passed over the sample for 100 hr (3.6×10^5 s) after which the sample was weighed to determine the weight loss.

E. Condensible Outgassing: In many situations it is important to know what products of outgassing from a material are condensible, thereby leading to contamination of, for example, optical surfaces.

Condensible degassing rates onto a gold-plated quartz substrate cooled to -125°C were determined using a quartz crystal microbalance (QCMB). In this test, a 2 to 5 gm sample was placed in a small vacuum furnace and the temperature was elevated to 52°C (max mass lander temperature anticipated). The furnace was then sealed except for a small orifice above which the cooled QCMB was located. The condensation rate was monitored continuously until a constant deposition rate was established, the time ranging from 1 to 4 days. Figure 6 is a schematic diagram of the test apparatus.

The results are presented in tabular form showing condensation rate (as % of original sample weight per day), temperature of the sample, and the duration of vacuum exposure prior to outgassing test.

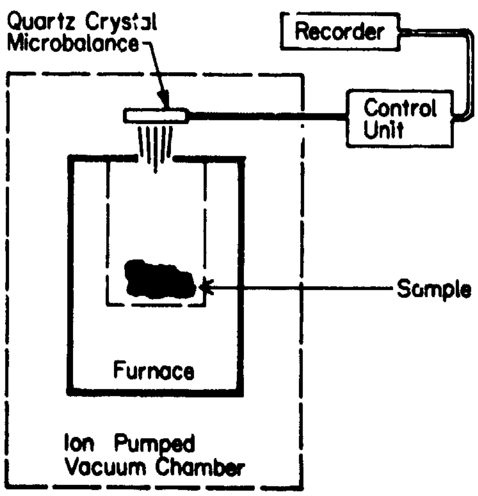


Figure 6
Schematic of Condensible Outgassing Products

II. Physical Property Tests

Twenty-nine different physical properties have been measured, each material being tested for its particular use. These tests are listed in Table 1 on page i. Points at which property determinations were made include before and after heat compatibility and after a 1-month thermal vacuum exposure, with some data at 3-, 6-, and 14-month thermal vacuum exposures. The results for any material are presented in tabular form showing the property measured against the parameter of interest and the ASTM or FTMS designation for the test procedure.

The thermal vacuum exposures were carried out in individual canisters. Four canisters were coupled directly to 50 ℓ/s ion pumps and the remaining 28 were connected to 7-canister plenums, with each plenum attached to a 400 ℓ/s ion pump. Each system was capable of maintaining pressures in the 10^{-7} to 10^{-8} torr range.

Two 2.5-in.-high vacuum valves between the canister and vacuum plenum permitted the canister to be removed from the pumping system and transferred to the test chamber without altering the pressure in the canister or plenum. A recirculating hot water heater maintained canister temperatures between ambient and 150°F.

The test chamber was constructed of 300-series stainless steel and consisted of two individual vacuum chambers separated by a 24-in. sliding gate valve. The main chamber was a nominal 5 ft in diameter and 7 ft long. The airlock chamber was 2 ft in diameter and 2 ft long, and a full opening door at the other end provided easy access to the chamber.

The 6-sq-ft chamber view window had three tempered glass sections each laminated of two layers of 0.75-in.-thick glass. Twenty-nine flanges on the main chamber ranged in size from a 1.5- to 8-in. tube size. The flanges were fitted with feedthroughs for high voltage, coaxial, high current, instrumentation, liquid nitrogen, and nude ion gages.

Three master/slave manipulators enabled access to over 90% of the chamber while it was evacuated. The manipulators were similar to those used in nuclear installations and each consisted of four major parts--the master arm, the slave arm, the seal tube assembly, and the tongs. Tong configurations could be changed remotely using a special fixture. The manipulators provided six degrees of freedom and had electric indexing in two axes for displacement of the master arm relative to the slave arm. All other motions were mechanical, with a one-to-one force ratio between the master arm and the slave arm except for the friction of the motion rods within the seal tube assembly. Figure 7 shows an operation being carried out in the chamber.

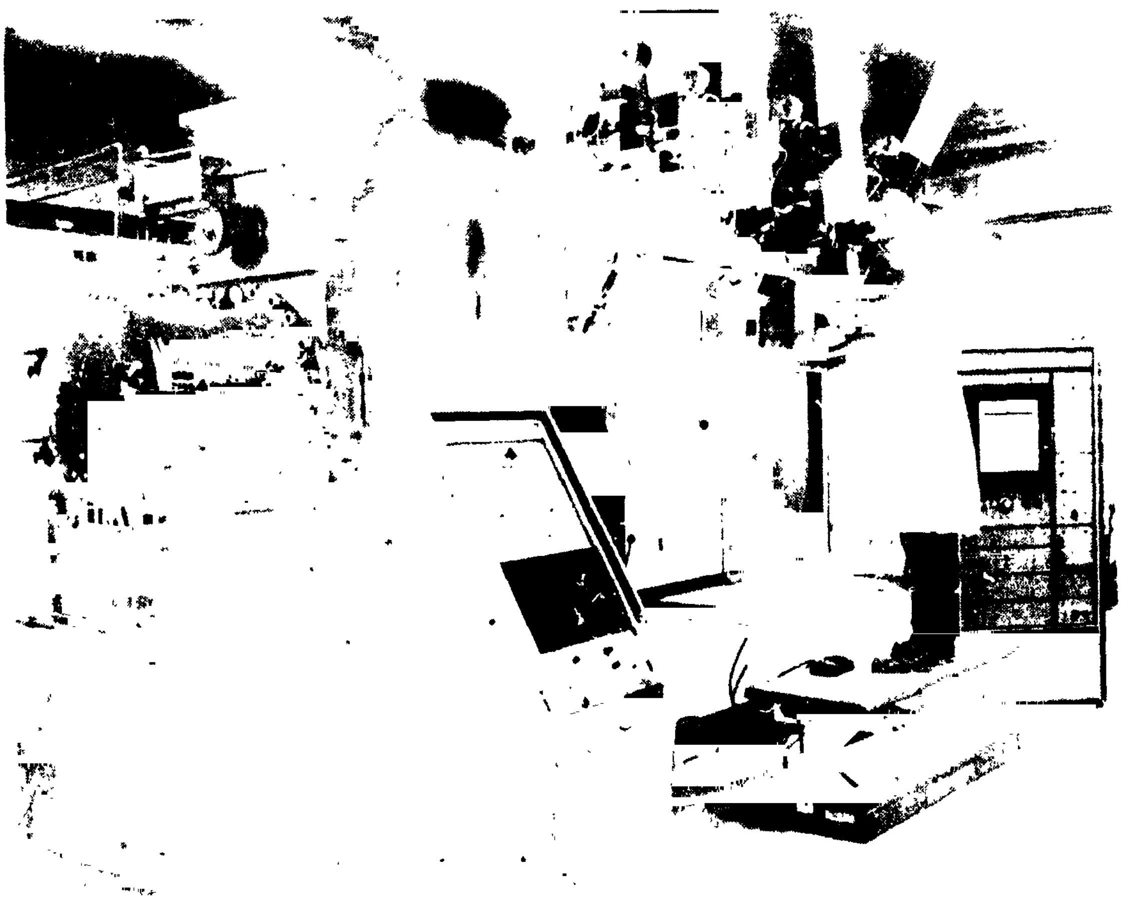


Figure 7
Test Chamber

A 10,000-lb universal test machine was coupled to the main chamber. The columns were shock isolated from the chamber with bellows, and the moving crosshead pull rod was attached to a bellows with a 14-in. stroke capability. Tensile, compression, flexure, and shear tests have been performed in this chamber. Electrical property tests, including dielectric strength, dielectric constant, and surface and volume resistivity, have been accomplished with the aid of special fixturing developed for use in vacuum with the master/slave manipulators. Thermal expansion measurements of heat shield materials have been made using fixtures designed to be handled with manipulators. Heating and cooling of test specimens was provided by radiant heaters (quartz lamps) and liquid nitrogen-cooled shrouds.

III. Qualification Criteria Used for Viking Materials

All proposed materials were given a screening TGA. There were no criteria for this test except judgment as to thermal stability. This judgment was based on how much weight loss occurred at the sterilization temperature and the temperature of the beginning of major decomposition of the material.

Once a material passed screening, qualification of the material for the Viking program was undertaken. The material was subjected to tests of (1) isothermal weight loss in N_2 and (2) condensible outgassing. If the isothermal weight loss was greater than 1% the material was rejected. If the condensible outgassing rate was greater than 1×10^{-4} %/day, the material was rejected. If the material passed these criteria it was permitted to undergo the physical property qualification tests that depended on the proposed use of the material. The criteria for the physical property qualification were determined by the design parameters for the material.

A TGA-RGA analysis was carried out as a baseline for comparison with all subsequent lots or batches of material. Rejection of an incoming sample occurred if:

1) The TGA curve of the new sample presented a total mismatch with the baseline curve;

2) The TGA weight loss in the temperature range between 25 and 135°C was more than 2% of the baseline TGA;

3) The RGA data showed major mass fragments different from the baseline major mass fragments;

4) The RGA data between 25 and 135°C showed mass fragments greater than m/e = 44 not present in the baseline RGA;

5) When the onset of major degradation varies more than 50 to -20°C from the baseline onset;

6) When the total weight loss (through major degradation) of composites indicates a filler content variation of greater than 5%.

During the course of the program changes in technical direction eliminated or modified some qualification tests so that not all materials reported here have the same data available.

DATA SECTION

PRECEDING PAGE BLANK NOT FILMED

Chemical Characterization Summary

Mix ratio: As received
Cure: As received

1. Isothermal Weight loss in Nitrogen: 0.37%

2. Steady-State Vacuum Condensible Degassing Rate: 1.329×10^{-4} %/day

3. TGA Conditioning:

TGA Vacuum: 100 hr at 125°C (398°K) in N_2 atmosphere
Nitrogen: 24 hr at 23°C (296°K) and 45% RH

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 25°C-370°C (298°K-643°K)

a_o = 94% of initial weight

$$k = 4.3\times10^{2} \exp\left(\frac{-14400}{1.98\ T^{o}K}\right) \min^{-1}$$

In Nitrogen:

Over the range: 200°C-370°C (473°K-643°K)

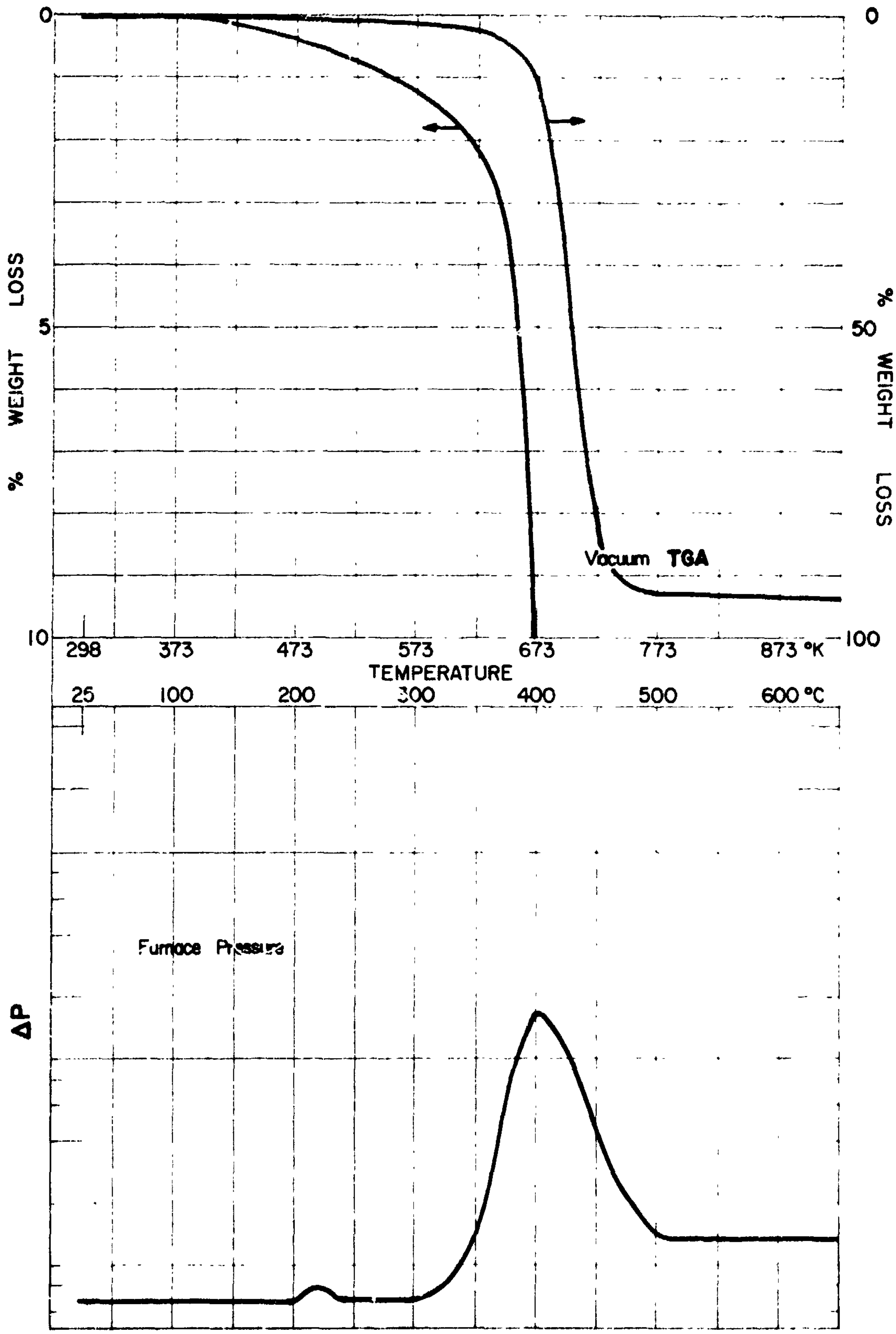
a_o = 83% of initial weight

$$k = 1.5\times10^{9} \exp\left(\frac{-32800}{1.98\ T^{o}K}\right) \min^{-1}$$

Time to 1% Weight Loss at Temperature T

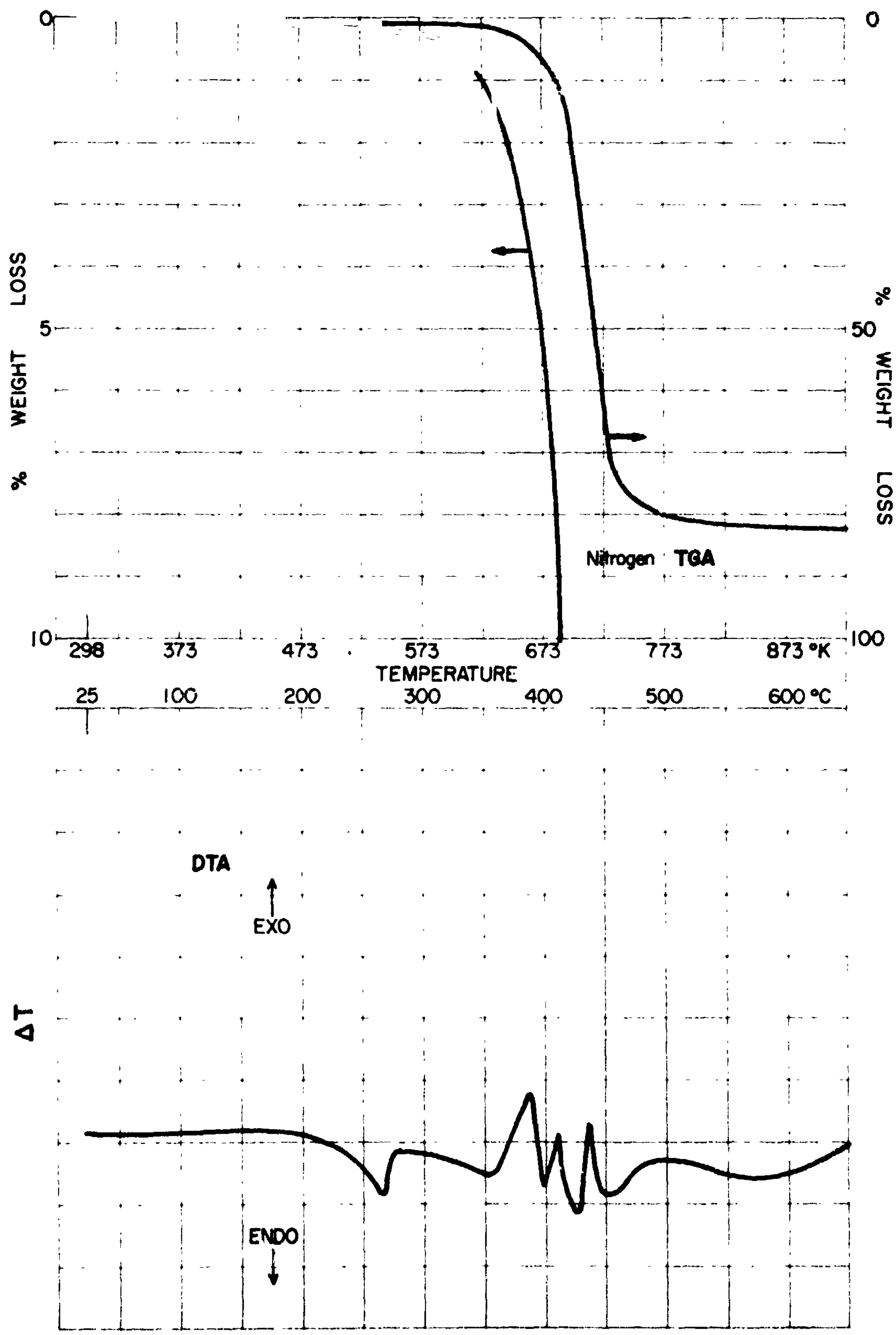
Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	8.6×10^{6}	7.8×10^{12}
100°C (373°K)	4.2×10^{5}	8.0×10^{9}
150°C (423°K)	4.1×10^{4}	4.0×10^{7}

Dacron Fabric Tape



D2

Dacron Fabric Tape



Dacron Fabric Tape

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	200	325	400	450	500	
14	1436	1300	1375	10880	698	1469	
15	181	234	610	19251	1604	751	
16	2550	2145	2042	14378	1371	2710	
17	11412	8116	7152	7906	730	6233	
18	40946	20792	25378	27358	2771	21563	
19	152	131	88	133		132	
20	136	127	91	323		151	
21							
22				512			
23							
24							
25						123	
26	105	125	253	12265	1071	1082	
27							
28	22947	20846	20302	71173	6324	25217	
29		202	1097	59408	3765	1102	
30		64	63	1125		100	
31			111			64	
32		5122	4663	4527	348	4157	
33							
34							
35							
36				45			
37					54	87	
38						173	
39					236		
40		1252	1255	3891	266	1177	
41						77	
42			47			99	
43		40					
44		370	1767	100759	10697	4502	
45					145	131	
46				157			
47							
48							
49						48	
50							
51				2719	719	1207	
52				562	108	230	
53				177		45	
54				52			
55				66			
56				50			
57							
58							
59							
60							
61							
62							
63				86		66	
64				48			
65				214		110	
66							
67							
68				367			
69				55			
70				142			
71							
72							
73							
74				233	68	98	
75				86		55	
76				109	118	64	
77				3715	932	1314	
78				1322	270	793	
79				75			
80							
81							
82							
83							
84							
85							
86							
87							
88							
89							
90							
91				148	47	342	
92						93	

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	200	325	400	450	500	
93							
94							
95							
96							
97							
98							
99							
100							
101							
102							
103				40			
104						52	
105				3690	706	912	
106				142			
107				42		45	
108							
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122				44	251	376	
123				1122			
124							
125							
126							
127							
128							
129			46	220			
130							
131				143		49	
132			41	184			
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Dacron Fabric Tape

Table 1 Tensile and Elongation*

Exposure	Average Tensile		Average Elon-gation	Samples Tested
	psi	Pa $x10^{-6}$		
Baseline	1040	7.17	43.5%	5
Heat Compatibility (1)	943	6.50	42.3%	5
30 day Thermal Vacuum (2)	971	6.69	43.6%	5
90 day thermal vacuum (2)	1003	6.92	45.8%	5
180 day thermal vacuum (2)	980	6.76	45.4%	5

*FTMS 191 Method 4108.1 (Test at room ambient)

(1) 240 hours at 275°F (408°K) in N_2 atmosphere

(2) Tested in air after heat compatibility (1) and exposure for the specified time at 150°F (338°K) and 10^{-6} Torr

Chemical Characterization Summary

Mix ratio: As received film
Cure: 3 hr at 165°F (347°K) followed by 1 hr at 275°F (408°K)

1. Isothermal Weight loss in Nitrogen: 0.85%

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum 24 hr at 23°C (296°K) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 25°C-275°C (298°K-548°K)

a_o = 7.6% of initial weight

$$k = 1.9 \times 10^5 \exp\left(\frac{-16800}{1.98\ T^{\circ}K}\right) \ \mathrm{min}^{-1}$$

In Nitrogen:

Over the range:

a_o = of initial weight

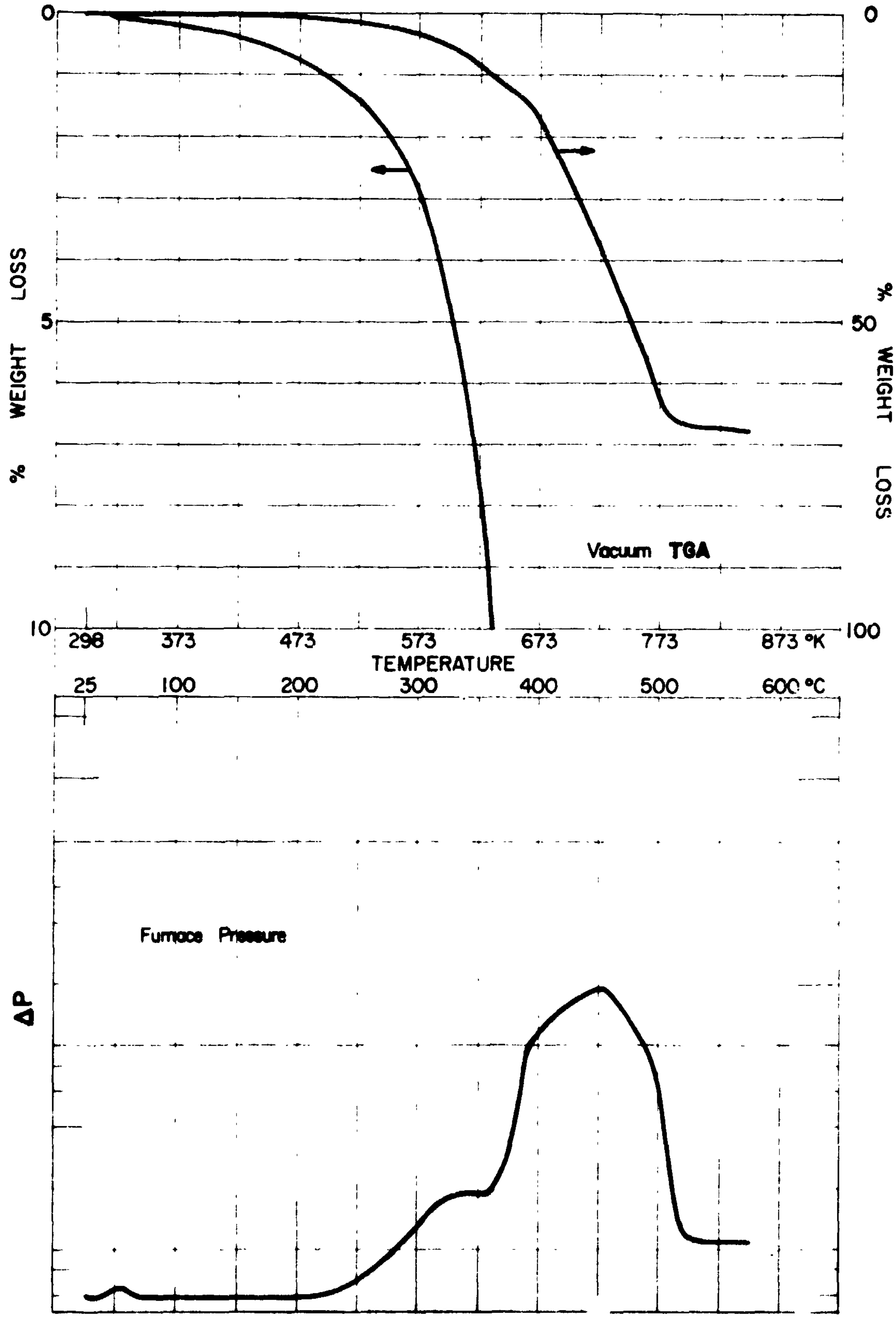
$$k = \quad \exp\left(\frac{-}{1.98\ T^{\circ}K}\right) \ \mathrm{min}^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	8.3×10^5	
100°C (373°K)	2.4×10^4	
150°C (423°K)	1.6×10^3	

PRECEDING PAGE BLANK NOT FILMED

Ablefilm 501-1



E2

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, ^{o}C

m/e	25	200	300	425	500		
14	1202	1180	1427	5589	1543		
15	585	624	1224	14082	1779		
16	3978	3660	3789	6427	3890		
17	11584	9380	9271	11079	8290		
18	35873	28021	27218	31973	22965		
19	156	149	174	549	122		
20	296	292	284	374	263		
21							
22							
23							
24			101	604	106		
25	52	62	275	2183	319		
26	239	287	1392	8873	1493		
27	504	530	1895	11145	1866		
28	12958	12442	14709	31474	14268		
29	241	300	1284	22941	1879		
30	738	734	868	5385	1006		
31			139	4510	357		
32	3294	2893	2774	2886	2432		
33							
34		40					
35			111				
36			284	559	112		
37			194	2756	253		
38		46	269	4690	429		
39			396	14195	1437		
40	2301	2244	2342	7614	2535		
41	81	93	393	6987	932		
42	64	90	414	5735	646		
43	88	126	1043	22943	1574		
44	767	870	1304	5849	1008		
45		52	129	3858	346		
46				304			
47			45	749	48		
48			41	142			
49			109	731	92		
50		47	198	3044	395		
51			95	3042	446		
52			110	1107	205		
53			90	1993	268		
54			93	492	77		
55			341	3033	268		
56			390	1023	154		
57			100	1835	192		
58			90	2696	278		
59			40	1635	133		
60			43	416	47		
61				922	88		
62				1275	134		
63				2420	289		
64	44	45		806	102		
65				5647	425		
66	51	53	70	7237	428		
67			47	693	80		
68			56	367	50		
69			81	328	66		
70				206			
71				217			
72				570	46		
73				607	60		
74				891	90		
75				427	62		
76				322	51		
77			45	2195	398		
78			50	845	181		
79			42	1154	203		
80				294	54		
81				150			
82				93			
83				98			
84	67	73	72	138	59		
85				146			
86				144			
87				369			
88				57			
89				405	67		
90				378	69		
91				1381	337		
92			49	262	74		

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	200	300	425	500		
93				421	42		
94				9932	492		
95				731	43		
96				96			
97				43			
98				51			
99				66			
100				87			
101				147			
102				124			
103				367	67		
104				102			
105				316	94		
106				89	42		
107				1630	305		
108				85[illegible]	163		
109				[illegible]			
110							
111							
112							
113							
114				53			
115				225			
116				77			
117				130			
118				109			
119				397			
120				153			
121				805	138		
122				226	45		
123							
124							
125							
126							
127							
128				42			
129	[illegible]	73	68	80	52		
130							
131	53	61	54	213	64		
132	67	67	62	135	57		
133				164			
134				280			
135				122			
136				172			
137							
138							
139							
140							
141							
142							
143							
144							
145				50			
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: As received sheet stock
Cure: 2 hrs at 225°F (380°K)

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: None (Room Ambient)
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 135°C-500°C (408°K-773°K)

a_o = 59% of initial weight

$$k = 7.5\times10^{13} \exp\left(\frac{-47000}{1.98\ T^{o}K}\right) \quad min^{-1}$$

In Nitrogen:

Over the range:

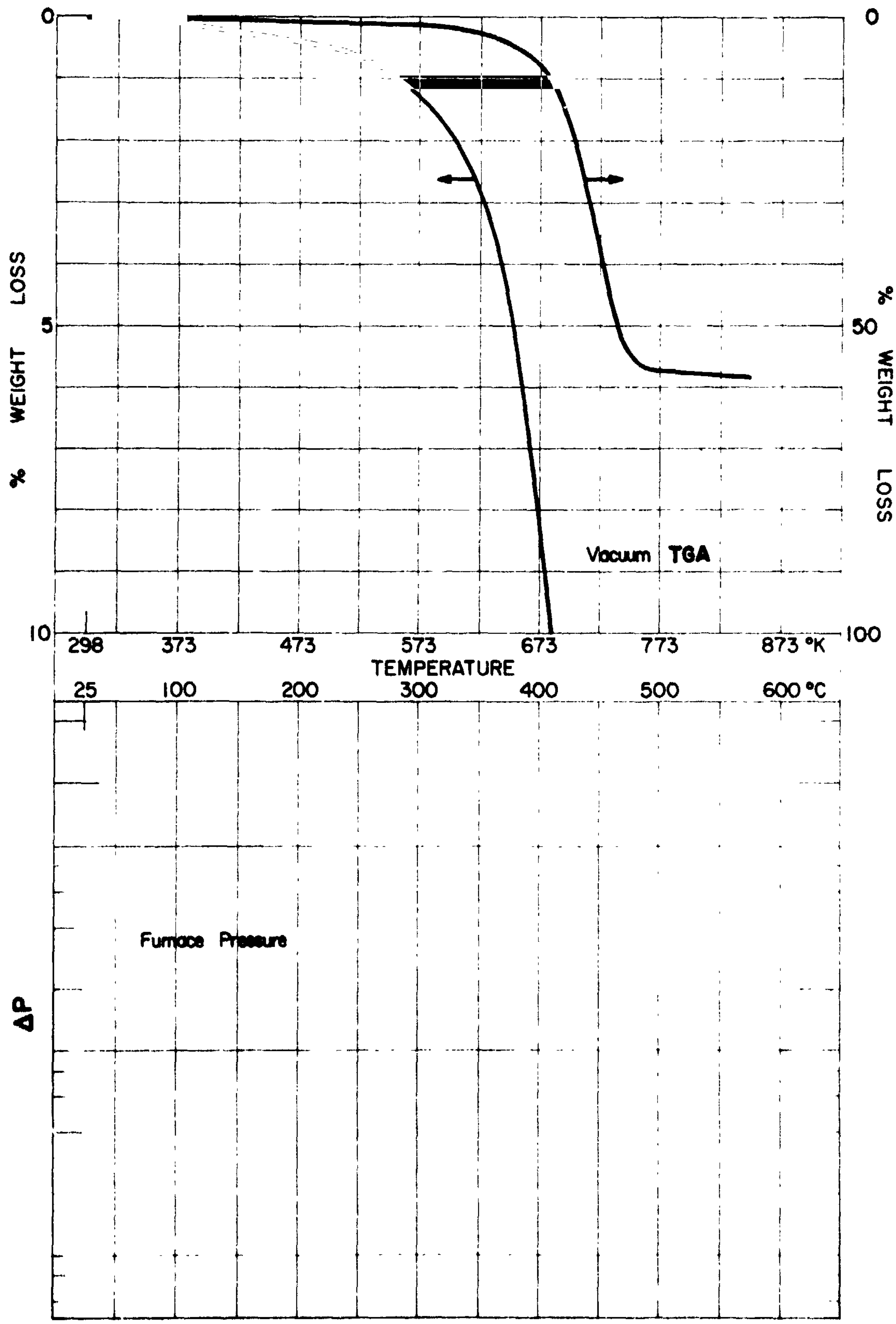
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \quad min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	7×10^{17}	
100°C (373°K)	3.2×10^{13}	
150°C (423°K)	1.8×10^{11}	

Ablefilm 517



E6

Chemical Characterization Summary

Mix ratio: Single component
Cure: 6 hr at 350°F (449°K).

1. Isothermal Weight loss in Nitrogen: 0.29%

2. Steady-State Vacuum Condensible Degassing Rate: 4.457×10^{-5} %/day

3. TGA Conditioning:

   TGA Vacuum: 100 hr at 125°C (398°K) in N_2 atmosphere
   Nitrogen:

4. Activation Energy of Decomposition:

   In Vacuum:

   Over the range: 250°C-350°C (523°K-623°K)

   a_o = 11% of initial weight

   $$k = 1.5 \times 10^{13} \exp\left(\frac{-38300}{1.98\ T^{o}K}\right) \ \text{min}^{-1}$$

   In Nitrogen:

   Over the range:

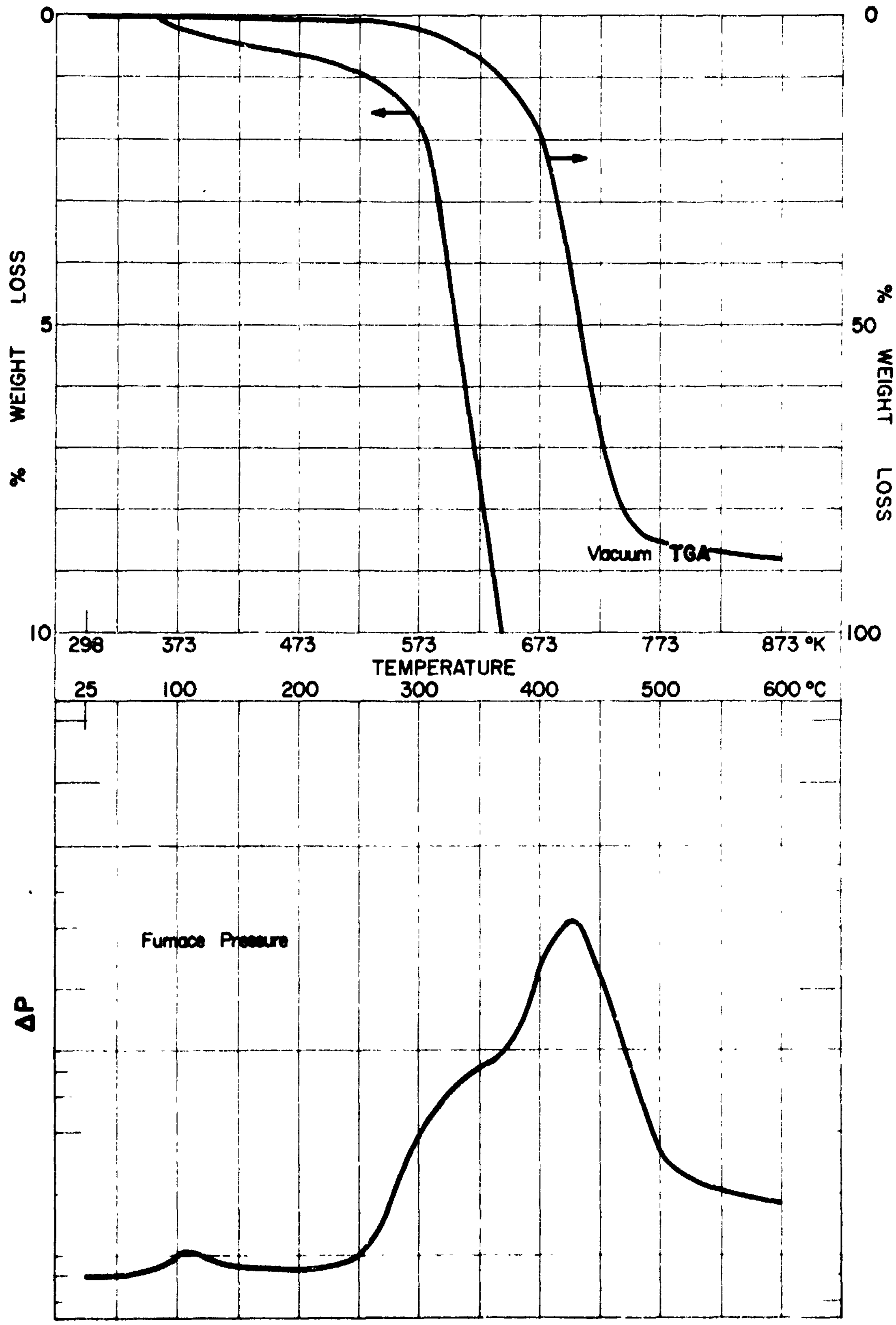
   a_o = of initial weight

   $$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \ \text{min}^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	4.3×10^{12}	
100°C (373°K)	1.4×10^{9}	
150°C (423°K)	2.8×10^{6}	

C7-4248


0
5
10
% WEIGHT LOSS
0
50
100
% WEIGHT LOSS
Vacuum TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
Furnace Pressure
ΔP

E8

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, ^{o}C

m/e	25	150	275	425	525		
14	470	451	609	6085	1321		
15	76	67	239	16431	2854		
16	2480	2467	2605	8245	5368		
17	9872	9179	9288	16754	8260		
18	33845	30753	30650	57568	25659		
19				410			
20	50	48	54	318	92		
21							
22							
23							
24				367	51		
25			50	2619	216		
26			250	13795	1733		
27	101	106	557	21211	2166		
28	9803	9801	11739	49035	14027		
29		65	329	30455	1131		
30	523	577	665	6136	964		
31			51	7539	37		
32	3025	3067	3014	3974	2861		
33				143			
34							
35							
36				300			
37				3594	85		
38				6829	182		
39			73	24520	1264		
40	626	651	788	9704	1244		
41			81	16179	442		
42			67	19629	251		
43			137	29320	599		
44	244	236	740	17302	902		
45				4275	73		
46				252			
47				585			
48				69			
49				506	44		
50				3797	281		
51				4271	304		
52				1208	150		
53				2842	164		
54				509			
55				3107	151		
56				2633	51		
57				27[illegible]6	53		
58			69	3289	64		
59				918			
60				286			
61				544			
62				1051	70		
63				2712	161		
64				601	45		
65				6404	217		
66				7545	35		
67				761			
68				318			
69				247			
70				143			
71				13[illegible]			
72				239			
73				337			
74				567			
75				232			
76				132			
77				2765	342		
78				608	56		
79				367	124		
80				15[illegible]			
81				85			
82				70			
83				57			
84				557			
85				101			
86				61			
87				156			
88							
89				160			
90				130			
91				1065	263		
92				132			

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	150	275	425	525		
93				156			
94				7422	[illegible]		
95				291			
96							
97							
98							
99							
100							
101							
102							
103				7[illegible]			
104							
105				45	40		
106							
107				411	[illegible]		
108				11[illegible]			
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: 100 pbw of part A to 33 pbw of part B
Cure: 96 hr at room temp plus 4 hr at 278°F (409°K)

1. Isothermal Weight loss in Nitrogen: 0.75%

2. Steady-State Vacuum Condensible Degassing Rate: 9.1×10^{-5} %/day

3. TGA Conditioning:

   TGA Vacuum: 100 hr at 125°C (398°K) in N_2 atmosphere
   Nitrogen: 24 hr at 23°C (296°K) and 45% RH

4. Activation Energy of Decomposition:

   In Vacuum:

   Over the range: 100°C-400°C (373°K-673°K)

   a_o = 43% of initial weight

   $$k = 4.7 \times 10^{24} \exp\left(\frac{-70000}{1.98\ T^{\circ}K}\right) \ \mathrm{min}^{-1}$$

   In Nitrogen:

   Over the range: 135°C-380°C (408°K-653°K)

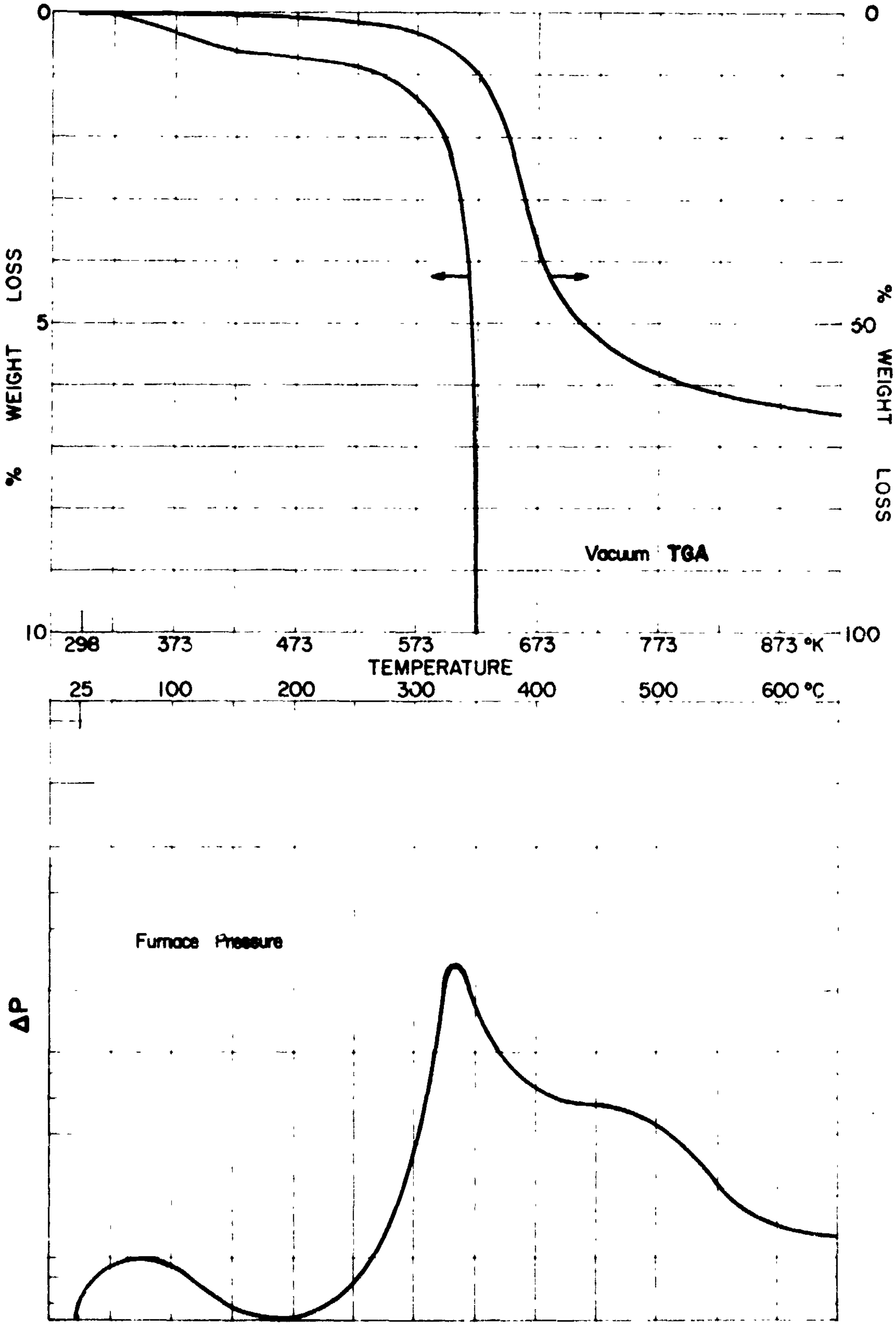
   a_o = 23% of initial weight

   $$k = 4 \times 10^{12} \exp\left(\frac{-37900}{1.98\ T^{\circ}K}\right) \ \mathrm{min}^{-1}$$

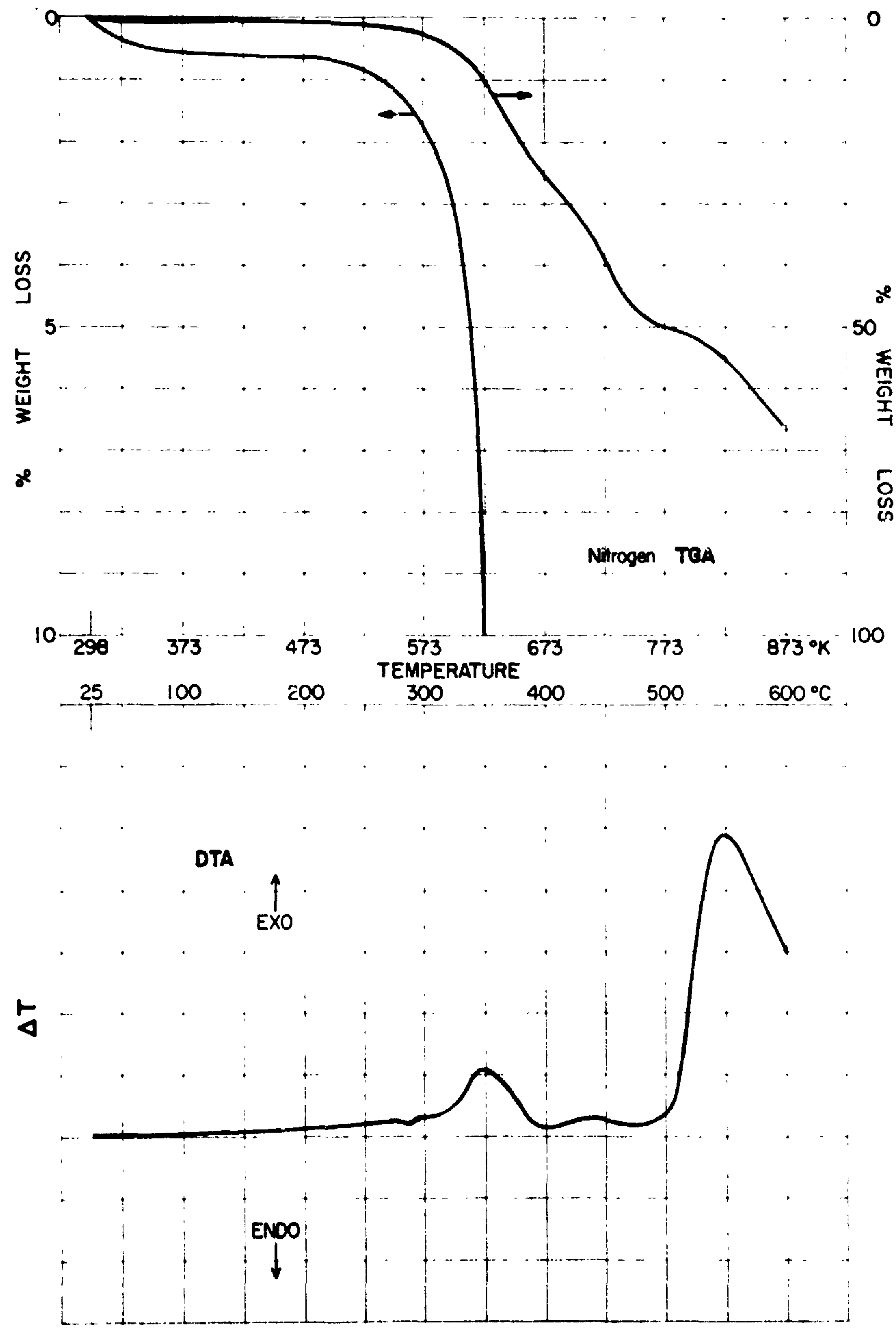
Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	7.8×10^{24}	8.6×10^{12}
100°C (373°K)	1.8×10^{19}	3.0×10^{7}
150°C (423°K)	1.5×10^{10}	6.6×10^{6}

EA934 Adhesive



E12


0
5
10
% WEIGHT LOSS
0
50
100
% WEIGHT LOSS
Nitrogen TGA
298 373 473 573 673 773 873 °K
TEMPERATURE
25 100 200 300 400 500 600 °C
DTA
EXO
ENDO
ΔT

MASS NUMBER AND RELATIVE PEAK INTENSITY
TEMPERATURE, °C

m/e	25	300	350	400	450	500	[illegible]
14	560	796	3022	1230	1152	1386	[illegible]
15	129	827	8305	2397	2429	3033	[illegible]
16	1951	3741	14236	4393	3943	4498	[illegible]
17	12954	18467	41299	15094	11576	10344	[illegible]
18	48262	65048	130264	49535	39872	[illegible]	[illegible]
19	42	118	176	127	42	[illegible]	[illegible]
20	89	127	276	143	109	100	[illegible]
21							
22							
23							
24			422	100	108	117	[illegible]
25		[illegible]	1952	663	580	564	[illegible]
26	44	993	13180	4443	4366	4043	[illegible]
27	76	1044	16218	6197	7465	6903	[illegible]
28	10230	13538	36439	18124	17149	16609	[illegible]
29	106	776	7677	2938	5325	4851	[illegible]
30		154	9887	1916	873	736	[illegible]
31		127	2837	394	109	64	
32	2530	2546	2844	2420	2258	2319	[illegible]
33			51				
34							
35							
36			149	60	44	42	
37		46	1946	509	290	[illegible]	
38		[illegible]	4043	1464	795	606	[illegible]
39		420	13088	4760	5291	4850	[illegible]
40	996	1594	8671	3407	2761	2600	[illegible]
41		282	6449	3182	7262	7060	[illegible]
42		372	9469	2182	3379	3037	[illegible]
43		571	6056	2672	5871	4318	[illegible]
44	155	2544	9614	1810	1219	743	[illegible]
45		101	1572	192	58		[illegible]
46			118	41			[illegible]
47			289	88			
48			72				
49			539	176	100	95	
50		78	3204	1550	792	522	
51		95	3616	1998	1091	[illegible]	[illegible]
52		110	2867	1049	469	329	
53		84	3193	1613	1124	628	[illegible]
54		42	1375	456	501	427	[illegible]
55			2255	1398	2430	2440	[illegible]
56		59	1853	699	1937	1719	[illegible]
57			1185	585	1878	1765	[illegible]
58		54	1889	177	149	100	[illegible]
59			549	40			
60			68	50			
61			713	122	51		
62			549	224	79	69	
63			1216	721	284	[illegible]	
64			652	153	66	69	
65			3294	1630	566	220	[illegible]
66		54	4366	1686	365	[illegible]	[illegible]
67		111	[illegible]	326	529	634	
68			[illegible]	128	173	186	
69			[illegible]	85	362	457	
70			[illegible]	126	553	497	
71			[illegible]	68	274	[illegible]	
72			[illegible]	42	52		
73			[illegible]				
74			204	76			
75			81	61			
76			127				
77			1230	1291	713	344	[illegible]
78			462	230	131	128	[illegible]
79			1627	727	388	228	[illegible]
80		40	1151	547	212	130	
81			377	105	134	163	
82			73	50	100	[illegible]	
83			52		60	[illegible]	
84			86		98	64	
85					73	73	
86							
87							
88							
89			[illegible]	56			
90			80	59			
91			209	242	197	143	[illegible]
92			74		44	49	

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	300	350	400	450	500	
93			269	63	57		
94		48	4030	1230	202	84	
95			[illegible]	43			
96							
97							
98							
99							
100							
101							
102							
103							
104							
105							
106							
107			560	278	[illegible]		
108			315	182	54		
109			47				
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

EA934 Adhesive

Table 1 Lap Shear Test* (ASTM D1002)

Exposure	Average		High		Low		Samples Tested
	psi	Pa $\times 10^{-7}$	psi	Pa $\times 10^{-7}$	psi	Pa $\times 10^{-7}$	
Baseline @ 75°F(297°K)	2420	1.67	2670	1.84	2150	1.48	10
Tested @ 75°F(297°K) after Heat Compatibility (1)	2190	1.51	2670	1.84	1940	1.34	10
Heat Compatibility Plus Thermal Cycle (1)(2)	2450	1.69	2730	1.88	2330	1.61	5
Tested @ +150°F(328°K) After Heat Compatibility(1)	2820	1.94	2940	2.03	2710	1.87	5
Tested at -50°F(228°K) After Heat Compatibility(1)	2320	1.60	2620	1.61	1970	1.36	5
Tested @ [illegible]10^{-5} Torr After Heat Compa[illegible]ity Plus Thermal Cy[illegible] Plus Thermal Vacuum (1)(2)(3)	2470	1.70	2670	1.84	2290	1.58	5

*Cured 96 hours room temperature plus 4 hours at 278°F(409°K)

(1) 24 days @ 275°F(403°K) in N_2 atmosphere

(2) 40 cycles from -50°F(227°K) to +150°F(338°K)

(3) 42 days @ 150°F(338°K) at 1×10^{-6} Torr

Chemical Characterization Summary

Mix ratio: 100 pbw of A and 58 pbw of B
Cure: 1 hr at 200°F (366°K)

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: None (Room Ambient)
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 25°C-400°C (298°K-673°K)

a_o = 67% of initial weight

$$k = 5.3\times10^{20} \exp\left(\frac{-58800}{1.98\ T^{o}K}\right) \quad \min^{-1}$$

In Nitrogen:

Over the range:

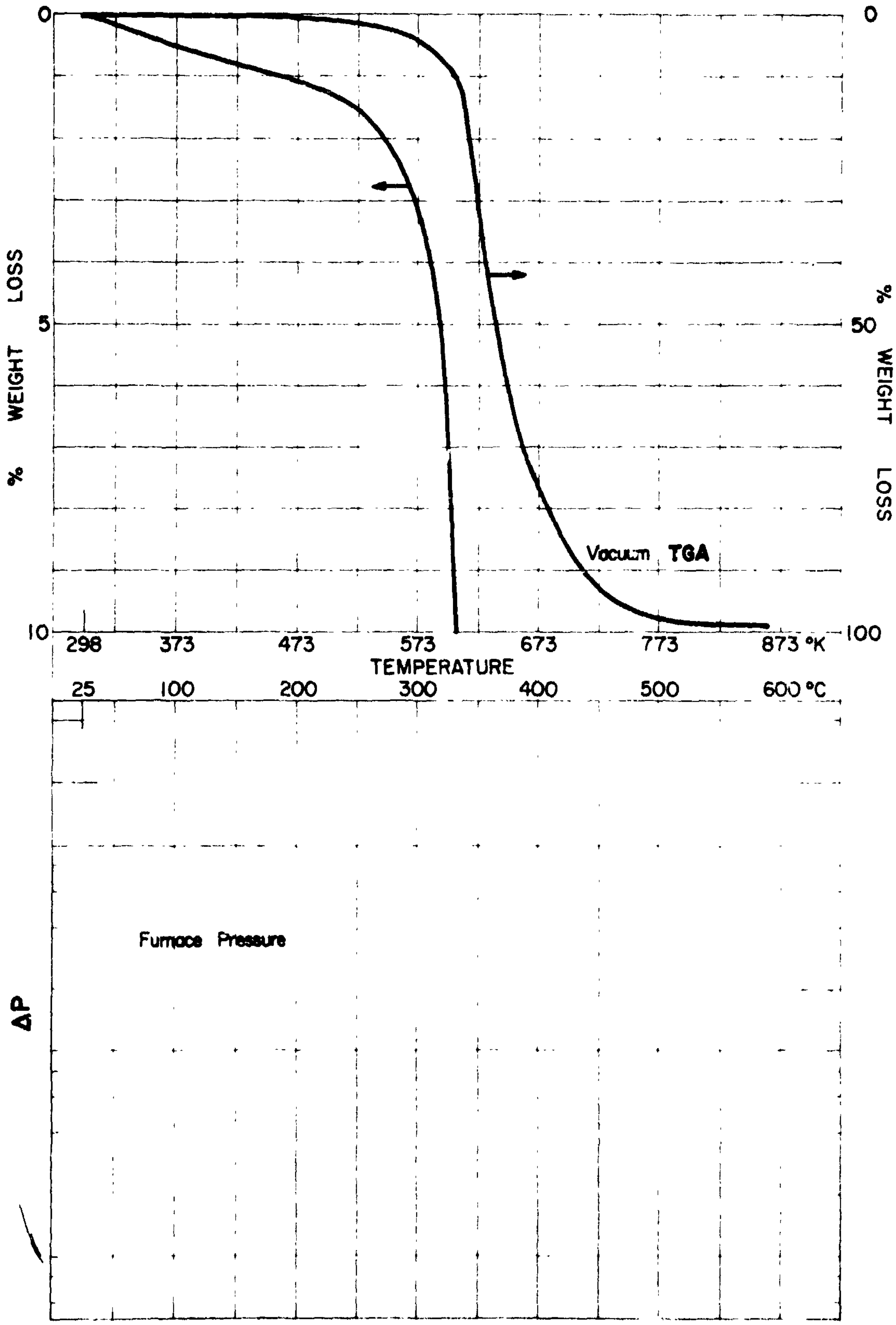
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \quad \min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	10^{19}	
100°C (373°K)	4.5×10^{13}	
150°C (423°K)	3.3×10^{9}	

EA956



0
0
5
10
% WEIGHT LOSS
50
% WEIGHT LOSS
100
Vacuum TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
Furnace Pressure
ΔP

E18

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	200	300	350	450	550	
14	672	718	1931	2971	1463	1144	
15	82	152	3388	7045	2950	2131	
16	2100	2218	11171	12738	5192	4732	
17	7232	8245	36457	28359	8083	6570	
18	23794	26619	100972	72848	21980	18838	
19	107	94	180	167	77	49	
20	161	224	455	401	274	210	
21							
22							
23							
24			122	268	93		
25			522	1266	497	100	
26	52	101	5509	10069	4514	867	
27	147	214	6581	13558	7721	1329	
28	16932	17710	30128	38206	25375	18027	
29	66	114	2906	[illegible]125	5130	398	
30	386	415	1586	878[illegible]	1758	671	
31	3594	3569	185	1733	101	53	
32			3739	3435	2859	2851	
33							
34							
35				40			
36			61	111	67		
37			357	891	202	57	
38			757	1963	736	120[illegible]	
39			3313	7217	5364	525	
40	1165	1236	4112	5816	3007	1450	
41			2120	5523	7103	437	
42			3407	7148	3042	214	
43		59	2421	4177	5245	191	
44	104	342	7902	7372	1134	375	
45			174	945	65		
46				51			
47				96			
48				67			
49			111	310	95	67	
50			792	2390	776	94	
51			650	2093	1029	134	
52			1026	2170	431	79	
53			662	1907	1007	107	
54			265	909	334	50	
55			217	991	2525	116	
56			300	1500	1571	87	
57			181	729	1571		
58			270	697	108		
59			60	218			
60				72	48		
61				109	60		
62			44	170	101		
63			76	407	272	62	
64			117	330	77		
65			153	822	489	85	
66			265	1085	231	78	
67			1526	1299	584	46	
68			71	232	150		
69				119	399		
70				179	416		
71				123	219		
72				54	42		
73				80			
74				85	40		
75				57			
76				74			
77			51	352	661	68	
78			105	229	117	40	
79			144	255	454	41	
80			194	799	143		
81			124	180	202		
82				66	72		
83				45	81		
84				42	82		
85				55	56		
86							
87							
88							
89					44		
90				56			
91				78	227	43	
92				66			

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	200	300	350	450	550	
93			66	79	63		
94			304	1033	128	49	
95			49	64	41		
96							
97							
98							
99							
100							
101							
102							
103							
104							
105							
106							
107				49	89		
108				88			
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: 100 pbw of part B to 140 pbw of part A
Cure: 72 hr at room temp plus 4.5 hr at 275°F (408°K)

1. Isothermal Weight loss in Nitrogen: 0.5%

2. Steady-State Vacuum Condensible Degassing Rate: 2.2×10^{-5} %/day

3. TGA Conditioning:

TGA Vacuum: 100 hr at 125°C (398°K) in N_2 atmosphere
Nitrogen: 24 hr at 23°C (296°K) and 45% RH

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 150°C-380°C (423°K-653°K)

a_o = 42% of initial weight

$$k = 5.5\times10^{16}\ \exp\left(\frac{-48500}{1.98\ T^{o}K}\right)\ \text{min}^{-1}$$

In Nitrogen:

Over the range: 25°C-340°C (298°K-613°K)

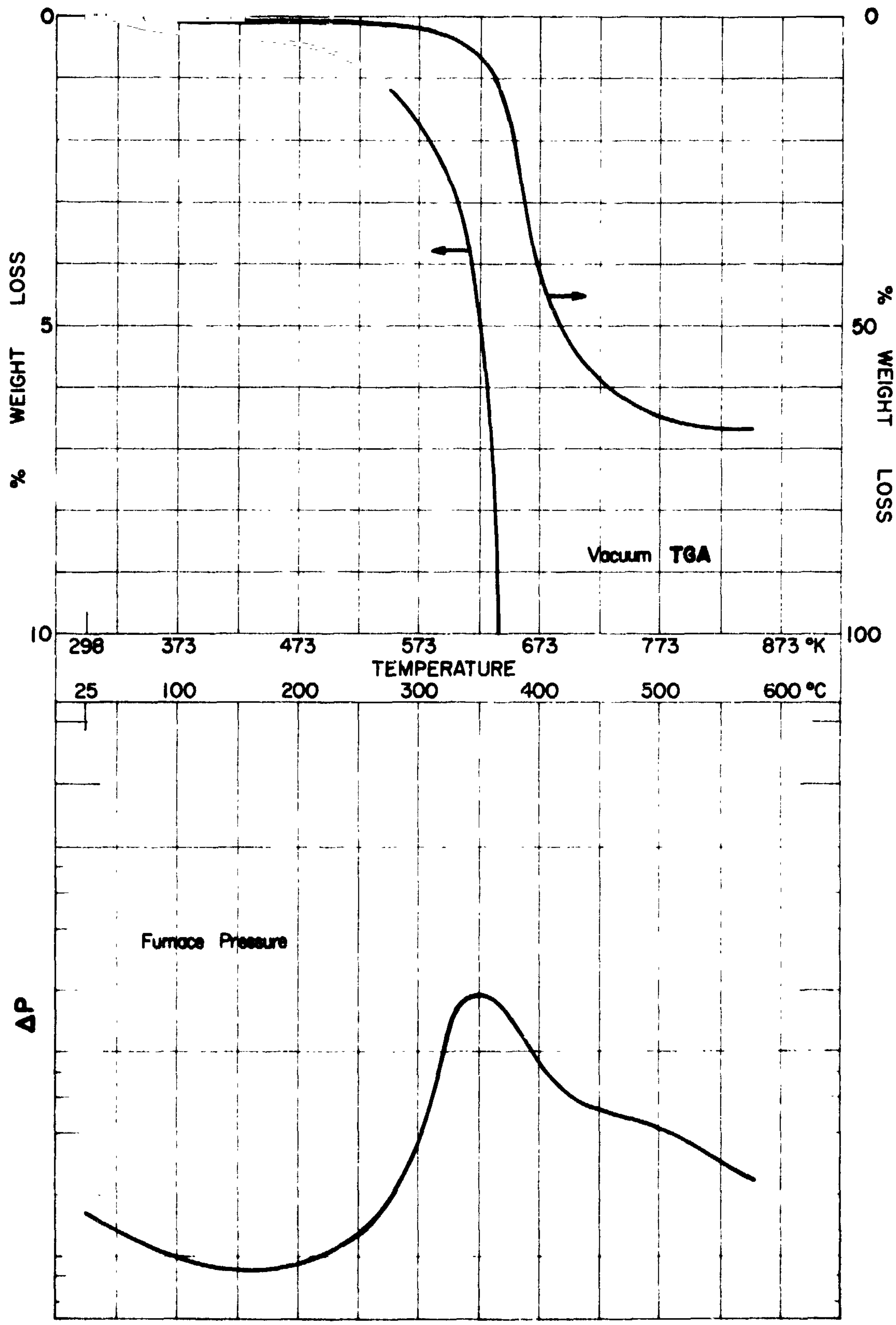
a_o = 7% of initial weight

$$k = 3.3\times10^{8}\ \exp\left(\frac{-24800}{1.98\ T^{o}K}\right)\ \text{min}^{-1}$$

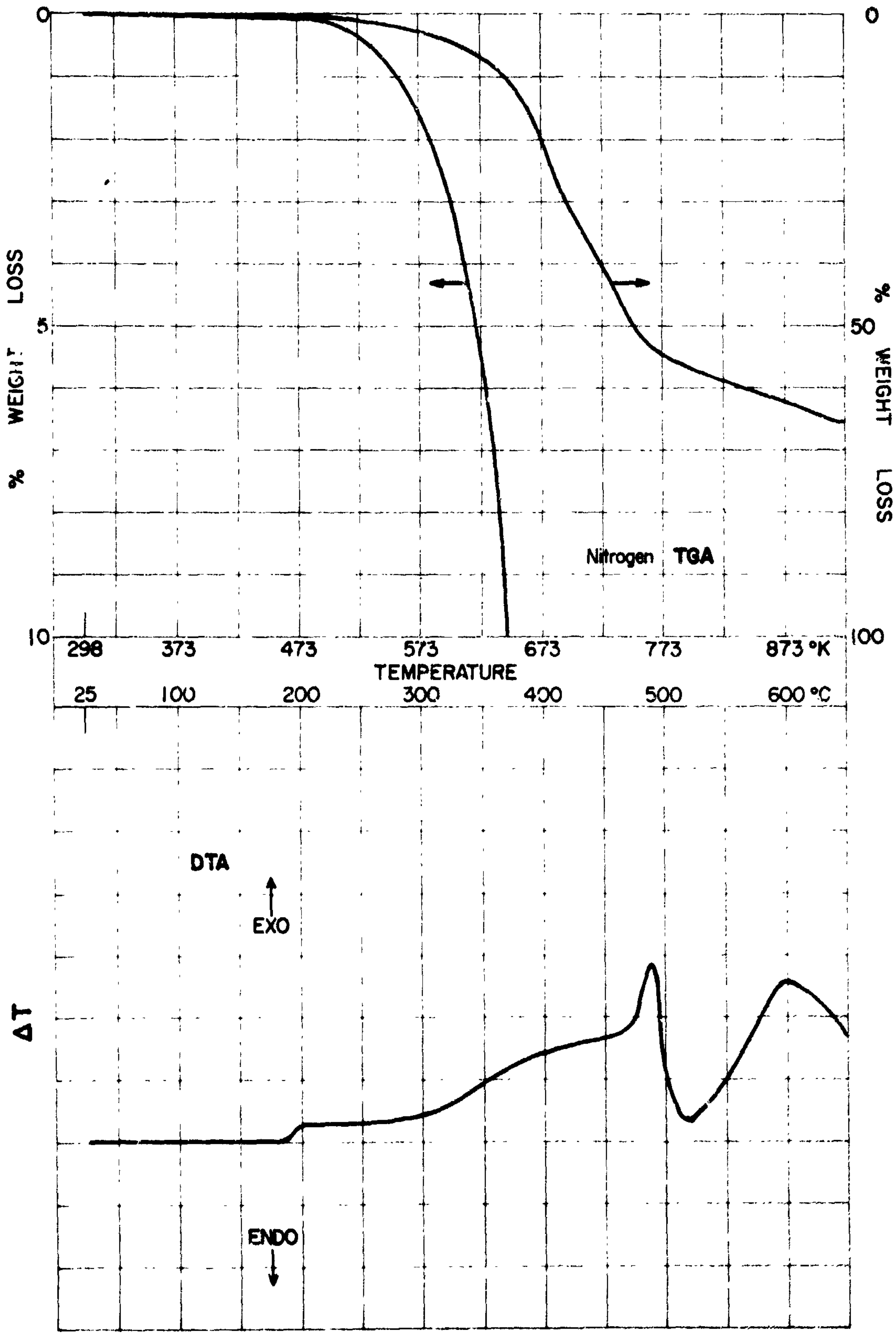
Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	1×10^{14}	1.3×10^{8}
100°C (373°K)	3.8×10^{9}	7.2×10^{5}
150°C (423°K)	2.5×10^{6}	1.3×10^{4}

EC-2216 Adhesive



EC-2216 Adhesive



MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	[illegible]	250	3[illegible]	4[illegible]		
14	203	268	192	1703	505	376	
15				4136	902	384	
16		668	561	3151	1415	1324	
17	07	8526	7074	14243	8566	1344	
18	35476	31884	17494	48935	32830	40126	
19				132			
20							
21							
22							
23							
24				138			
25				750	[illegible]	61	
26				5944	1746	669	
27		48	51	8633	281	675	
28	6382	6281	6172	18714	10251	427	
29			62	8394	2705	[illegible]	
30				2244	271	105	
31				2560	261	42	
32	1210	1089	365	1351	356	766	
33				51			
34							
35							
36				52			
37				605	77		
38				1397	141	60	
39				6505	1654	436	
40	44			2135	305	113	
41				4802	2092	598	
42				4115	712	182	
43				4053	1397	351	
44	59	65	142	3760	660	241	
45				1862	185	74	
46							
47				59			
48							
49				112			
50				766	92		
51				775	167	54	
52				646	62		
53				431	123		
54				376	83		
55				873	342	110	
56				881	230	83	
57				529	178		
58				342			
59				155			
60							
61				[illegible]			
62				44			
63				[illegible]			
64				84			
65				[illegible]	69		
66				[illegible]	34		
67				276	57		
68				[illegible]			
69				141	44		
70				47	41		
71				[illegible]			
72							
73				40			
74							
75							
76							
77				131	51		
78					62		
79					205		
80					63		
81					48		
82							
83							
84							
85							
86							
87							
88							
89							
90							
91				68			
92							

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	100	250	375	450	500	
93				102			
94				410			
95							
96							
97							
98							
99							
100							
101							
102							
103							
104							
105							
106							
107							
108							
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Table 1 Lap Shear* (ASTM D1002-64)

Exposure	Average		High		Low		Samples Tested
	psi	Pa $\times 10^{-7}$	psi	Pa $\times 10^{-7}$	psi	Pa $\times 10^{-7}$	
Baseline	3890	2.68	4090	2.82	3650	2.28	10
Heat Compatibility (1)	3920	2.70	4490	3.10	3310	2.28	10
Heat Compatibility Plus Thermal Cycle (1)(2)	3840	2.65	4700	3.24	3310	2.28	5
Thermal Vacuum (3)	3870	2.67	4340	2.99	3400	2.34	5

*Cured 72 hours at room temperature plus 4.5 hours at 275°F (408°K)

(1) Heat compatibility - 571 hours at 275°F (408°K) in N_2 atmosphere

(2) Cycled 40 times between -50°F (228°K) and +150°F (338°K) with 30 minutes stabilization at each temperature

(3) Thermal vacuum - tested at 1×10^{-5} Torr after 42 days at 150°F(338°K) at 1×10^{-6} torr preceded by heat compatibility exposure (1).

Chemical Characterization Summary

Mix ratio: As received sheet stock
Cure: As received

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: 24 hr at $23^{o}C$ ($296^{o}K$) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: $260^{o}C$-$310^{o}C$ ($533^{o}K$-$583^{o}K$)

a_o = 21% of initial weight

$$k = 6.85 \times 10^{10} \exp\left(\frac{-32300}{1.98\ T^{o}K}\right) \quad min^{-1}$$

In Nitrogen:

Over the range:

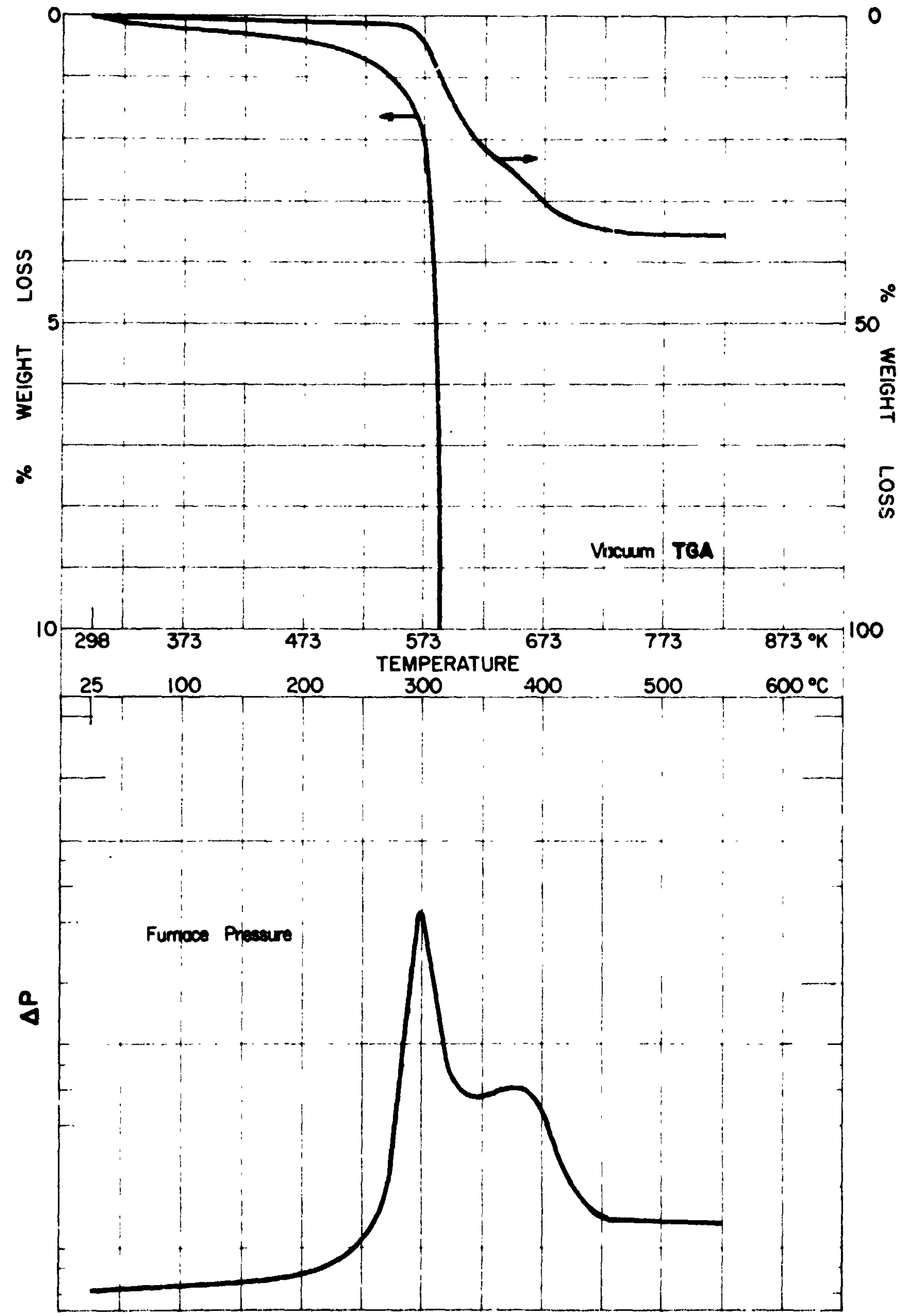
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \quad min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
$50^{o}C$ ($323^{o}K$)	8.5×10^{10}	
$100^{o}C$ ($373^{o}K$)	8.9×10^{7}	
$150^{o}C$ ($423^{o}K$)	4.8×10^{5}	

EG 818T Laminate



E28

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	150	275	350	425	500	
14	397	599	574	882	602	501	
15	79	228	915	1193	680	706	
16	1713	1693	3002	2751	1684	2097	
17	7007	6592	8741	8317	5484	5393	
18	29067	23955	29337	26626	20386	19645	
19	306	413	400	382	157	184	
20	111	99	172	264	137	106	
21							
22							
23							
24				73			
25			64	452	241	63	
26	73	209	851	3347	1912	1142	
27	175	481	1617	2942	2142	1177	
28	15192	19455	20974	23621	21013	20266	
29	107	421	704	2029	1355	570	
30	67	227	238	312	306	216	
31		93	46	279	139	71	
32	4941	4769	4500	4090	3900	3702	
33		43					
34							
35							
36				257	100		
37				1086	499	81	
38			48	2320	1040	241	
39		63	324	7253	4044	1332	
40	1472	1466	1764	4619	2798	1843	
41		56	152	1030	679	288	
42		279	432	1063	507	139	
43		143	371	2501	1794	219	
44	325	1331	8000	5769	1010	1180	
45		224	64	93	51		
46				63			
47				317	59		
48							
49				278	85		
50			150	1784	1081	371	
51			86	1651	1419	417	
52			111	363	294	105	
53				1009	607	152	
54				109	69		
55				1556	601	142	
56			50	222	50		
57				75			
58				71	70		
59							
60							
61				303	156		
62				746	251		
63				1514	802	171	
64				[illegible]	136		
65				4847	2252	522	
66			[illegible]	6189	2426	537	
67				259	63		
68				147			
69							
70							
71							
72							
73		202					
74				240	92		
75				120			
76				44	46		
77				831	1253	302	
78			40	173	215	60	
79			51	337	366	124	
80					45		
81				64			
82							
83							
84							
85							
86							
87							
88							
89				53	45		
90						41	
91							
92				617	685	199	

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	150	275	350	425	500	
93				71			
94			280	260	81		
95				9337	3391	774	
96			138	386	51		
97				78			
98							
99							
100							
101							
102							
103							
104				46	56		
105							
106					43		
107							
108				51	203	69	
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120				115	68		
121							
122				153	213		
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135				42			
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: 100 pbw of A to 100 pbw of B to 1 pbw of D-2.
Cure: 4 hr at 65°C (338°K) plus 4 hr at 150°C (423°K).

1. Isothermal Weight loss in Nitrogen: 0.14%

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum·

Over the range: 135°C-350°C (408°K-623°K)

a_o = 96% of initial weight

$$k = 5.1 \times 10^{4} \exp\left(\frac{-19300}{1.98\ T^{o}K}\right) \min^{-1}$$

In Nitrogen:

Over the range:

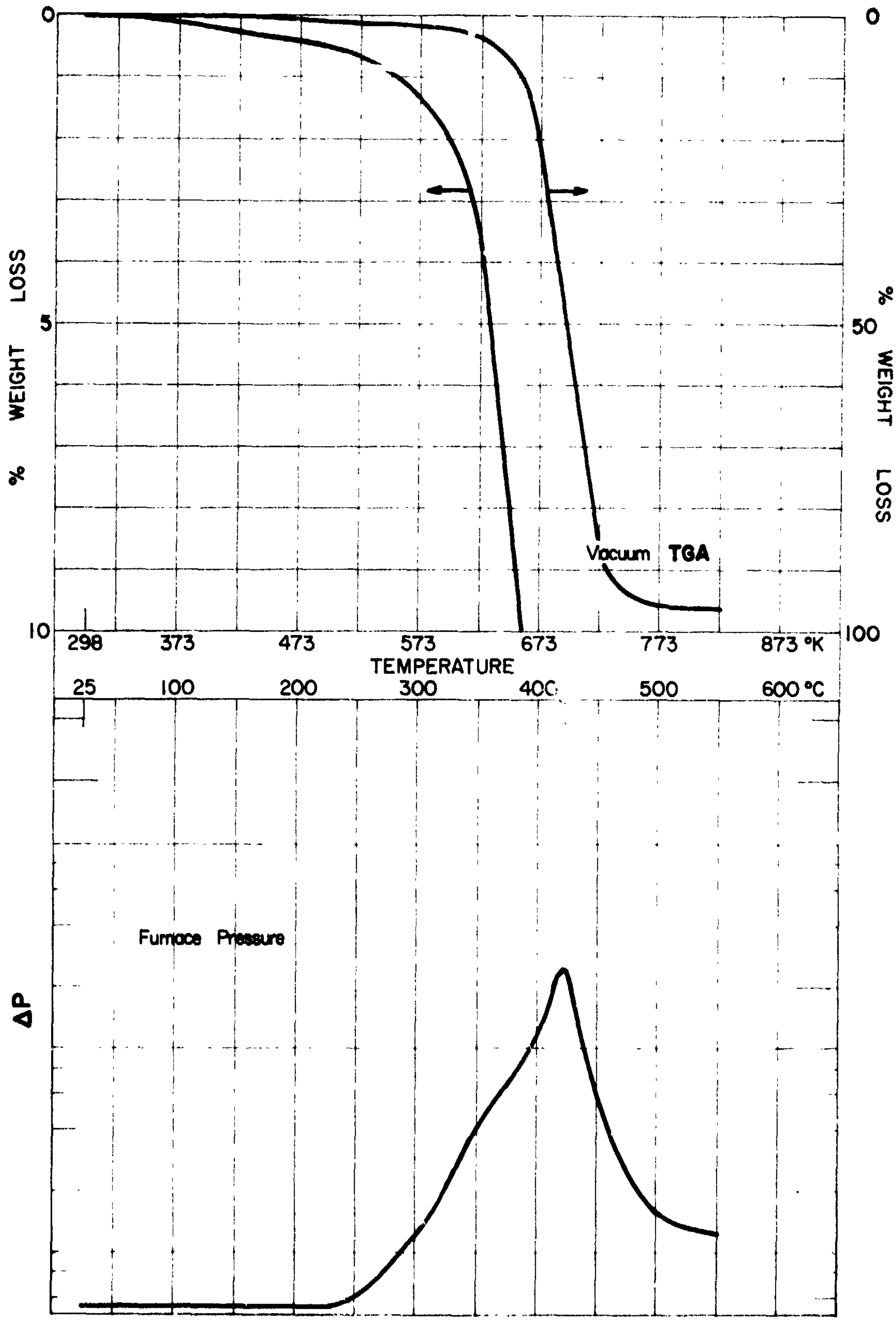
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	1.5×10^{10}	
100°C (373°K)	2.7×10^{8}	
150°C (423°K)	1.2×10^{7}	

Epocast 203



E32

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	200	325	425	525		
14	2943	2848	3290	12000	4065		
15	1049	1166	2703	37584	4774		
16	9896	9907	10359	24288	13046		
17	33182	28551	26557	38439	26732		
18	103536	84358	77415	112671	74214		
19	180	149	137	1404	110		
20	613	493	514	1392	567		
21							
22				621			
23							
24			84	2471	57		
25			630	9093	614		
26	491	646	4394	58008	3716		
27	1125	1311	7268	138942	6079		
28	29589	29146	38171	149415	38854		
29	429	512	2831	50373	2632		
30	2099	2190	2588	8364	2894		
31		60	477	9489	301		
32	8675	8258	8139	10314	7944		
33							
34							
35							
36				1893			
37			412	11370	310		
38			873	26430	305		
39	67	161	6024	156741	4456		
40	5167	5300	6518	41352	7111		
41	91	172	4068	102009	2513		
42	55	90	960	14907	720		
43	112	165	852	26817	1400		
44	1657	1834	5863	43146	3692		
45			135	7218	163		
46				1167			
47				1578			
48				792			
49			102	4068	51		
50			1267	25917	1004		
51			1313	34494	1402		
52			940	19953	562		
53			1625	40113	1012		
54			7109	173262	2659		
55		62	1221	28470	711		
56			597	9651	215		
57			176	4713	44		
58			43	3249			
59				798			
60				1938			
61				3057			
62				5148	109		
63			159	11310	556		
64				3639	60		
65			523	21990	770		
66			564	22320	600		
67			8325	196395	3194		
68			527	14358	126		
69				1608			
70				645			
71				516			
72				804			
73				1932			
74				4011	45		
75				2178			
76				2010			
77			507	18129	972		
78			207	6609	339		
79			1034	22185	753		
80			317	6927	113		
81			763	18171	291		
82			6866	145221	2209		
83			343	10701	65		
84				1098			
85				531			
86				723			
87				702			
88				399			
89				2148			
90				1884			
91				6303	829		
92				1467	56		

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	200	325	425	525		
93				1806			
94			192	18870	464		
95				1851			
96				567			
97				426			
98				393			
99				453			
100							
101				402			
102				771			
103				1722			
104				837			
105				1551	205		
106				561			
107				6759	390		
108			82	5013	142		
109				1542			
110				1173			
111							
112				432			
113				324			
114							
115							
116				1317			
117				555			
118				759			
119				912			
120				1800			
121				780			
122				3090	50		
123				1221			
124				360			
125							
126							
127							
128				369			
129				521			
130				528			
131				315			
132				1218			
133				771			
134				786			
135				1260			
136				660			
137				783			
138							
139				303			
140							
141							
142							
143							
144							
145							
146				423			
147				321			
148				309			
149				315			
150							
151				318			
152							
153							
154							
155							
156							
157							
158							
159							
160				309			
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: 100 pbw of resin to 14 pbw of hardener
Cure: 1 hr at 150°F (339°K) plus 2 hr at 250°F (394°K) plus 2 hr at 350°F (450°K)

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

   TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
   Nitrogen:

4. Activation Energy of Decomposition:

   In Vacuum:

   Over the range: 200°C-500°C (473°K-773°K)

   a_o = 50% of initial weight

   $$k = 1.8\times10^{8} \exp\left(\frac{-30200}{1.98\ T^{o}K}\right) \quad min^{-1}$$

   In Nitrogen:

   Over the range:

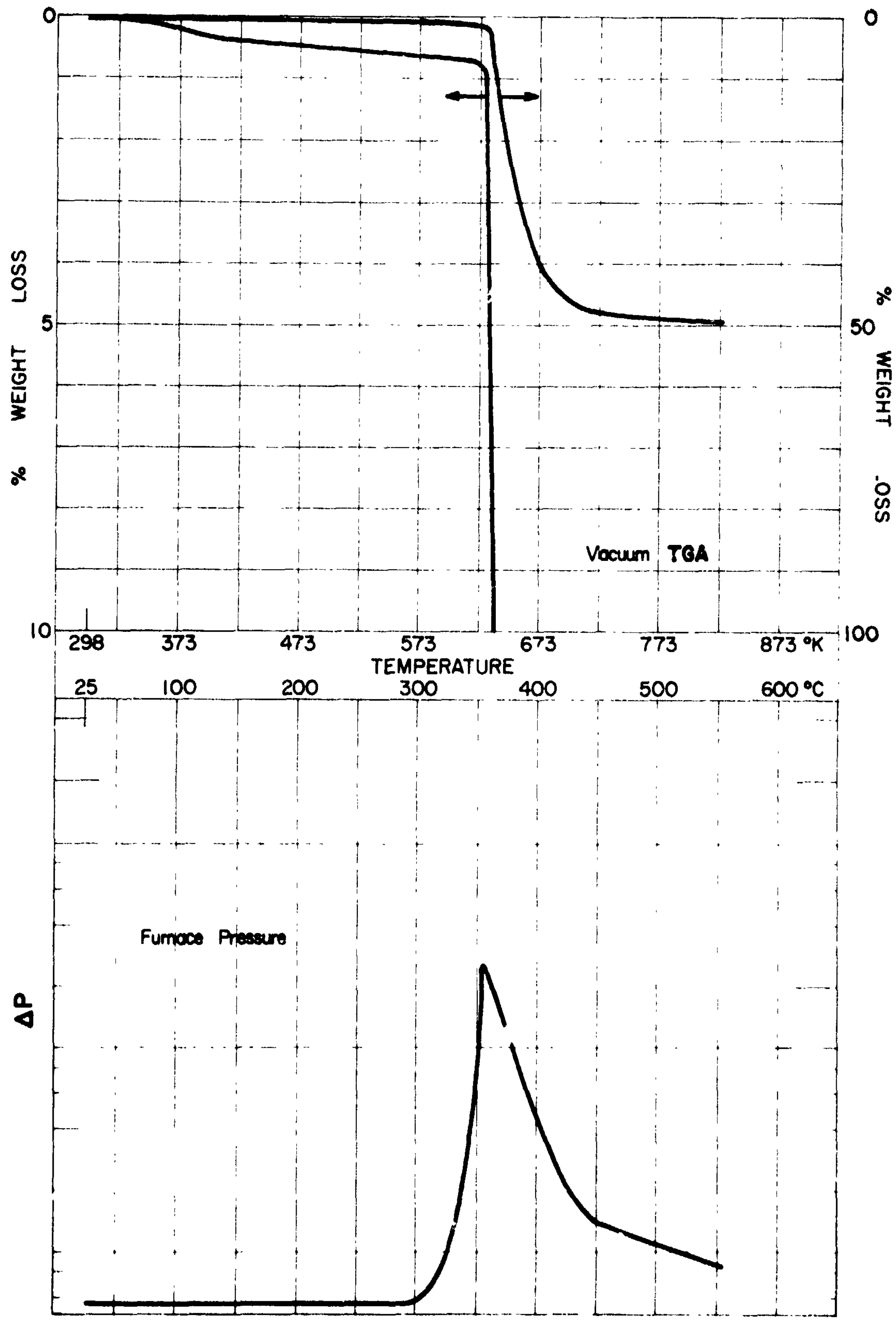
   a_o = of initial weight

   $$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \quad min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	1.1×10^{12}	
100°C (373°K)	2×10^{9}	
150°C (423°K)	1.5×10^{7}	

Epon 828 MPDA/120 Fiberglass Cloth



E36

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	350	400	500			
14	7838	12404	10050	8657			
15	326	13787	4010	2760			
16	4977	14401	7494	6981			
17	13706	37368	14816	9951			
18	51566	101180	53023	35913			
19	41	279	188	64			
20	479	842	608	481			
21							
22		92					
23							
24		761	395	92			
25	63	3004	1495	572			
26	385	11509	7677	2959			
27		10002	8855	3791			
28	110340	141330	122680	111790			
29	1124	27450	6605	2694			
30	509	3180	1669	1129			
31		3108	1241				
32	24848	26419	23917	22903			
33		184	104				
34	82	110	60	101			
35		176	55				
36		649	354	93			
37		4254	2469	328			
38		7420	5246	828			
39	163	20795	17928	2852			
40	6261	16410	12129	7586			
41	167	4994	3989	1306			
42	139	7052	2409	698			
43	273	19105	4420	1070			
44	1035	26394	3499	1626			
45	105	2796	885	225			
46		442	240				
47		1915	749				
48		276	123				
49		1795	1067	159			
50	42	8601	5948	926			
51	54	5316	7719	1231			
52		2599	2665	451			
53		3270	4294	652			
54		966	806	170			
55		6281	3932	537			
56		1678	512	131			
57		2034	519	92			
58		1906	438	101			
59		428	284				
60		1150	711	61			
61		1856	1352	165			
62		2988	2609	337			
63		5725	5988	819			
64		1751	1969	231			
65		15102	10747	1233			
66		18896	9428	969			
67		1580	1190	167			
68		1035	496				
69		466	[illegible]				
70		332	81				
71		84	56				
72		282	136				
73		[illegible]	508	74			
74		1982	1628	194			
75		805	1119	103			
76		570	855	100			
77		2503	8267	1293			
78		1137	2587	446			
79		1735	3672	523			
80		654	831	128			
81		410	406	43			
82		224	87				
83		104					
84		109	42				
85		67	88				
86		145	184				
87		75	240				
88							
89		1088	1633	204			
90		837	1153	170			
91		1603	6389	1199			
92		455	936	170			

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	350	400	500			
93				103			
94		37745	1526	1331			
95		245	976	68			
96		206	48				
97							
98							
99							
100							
101							
102		111	341	47			
103		351	1706	206			
104		138	390	77			
105		350	1175	372			
106		153	293	109			
107		1462	5792	1049			
108		1099	2806	464			
109		97					
110			201				
111							
112							
113							
114							
115							
116		356	851	105			
117		61	186				
118		121	425	102			
119		1127	461	60			
120		1025	3427	327			
121		376	1008	115			
122		1433	5179	505			
123		266	1208	159			
124			65				
125							
126							
127							
128							
129			127	41			
130			99				
131			49				
132		270	596	113			
133		121	270	60			
134		332	994	65			
135		1121	2847	245			
136		22[illegible]	920	128			
137		314	984	80			
138			74				
139							
140							
141							
142							
143							
144							
145			42				
146		95	229	60			
147			37				
148			113				
149		120	182				
150		52	168				
151		42	166				
152							
153							
154							
155							
156							
157							
158							
159		65	51				
160			102				
161							
162							
163							
164		75	108				
165		159	68				
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: 100 pbw of A to 4 pbw of B
Cure: 20 min at 212°F (373°K) plus 24 hr at 280°F (411°K) and 10^{-5} Torr

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

   TGA Vacuum: None (Room Ambient)
   Nitrogen:

4. Activation Energy of Decomposition:

   In Vacuum:

   Over the range: 25°C-360°C (298°K-633°K)

   a_o = 32% of initial weight

   $$k = 1.35\times10^{4} \exp\left(\frac{-17500}{1.98\ T^{\circ}K}\right) \text{ min}^{-1}$$

   In Nitrogen:

   Over the range:

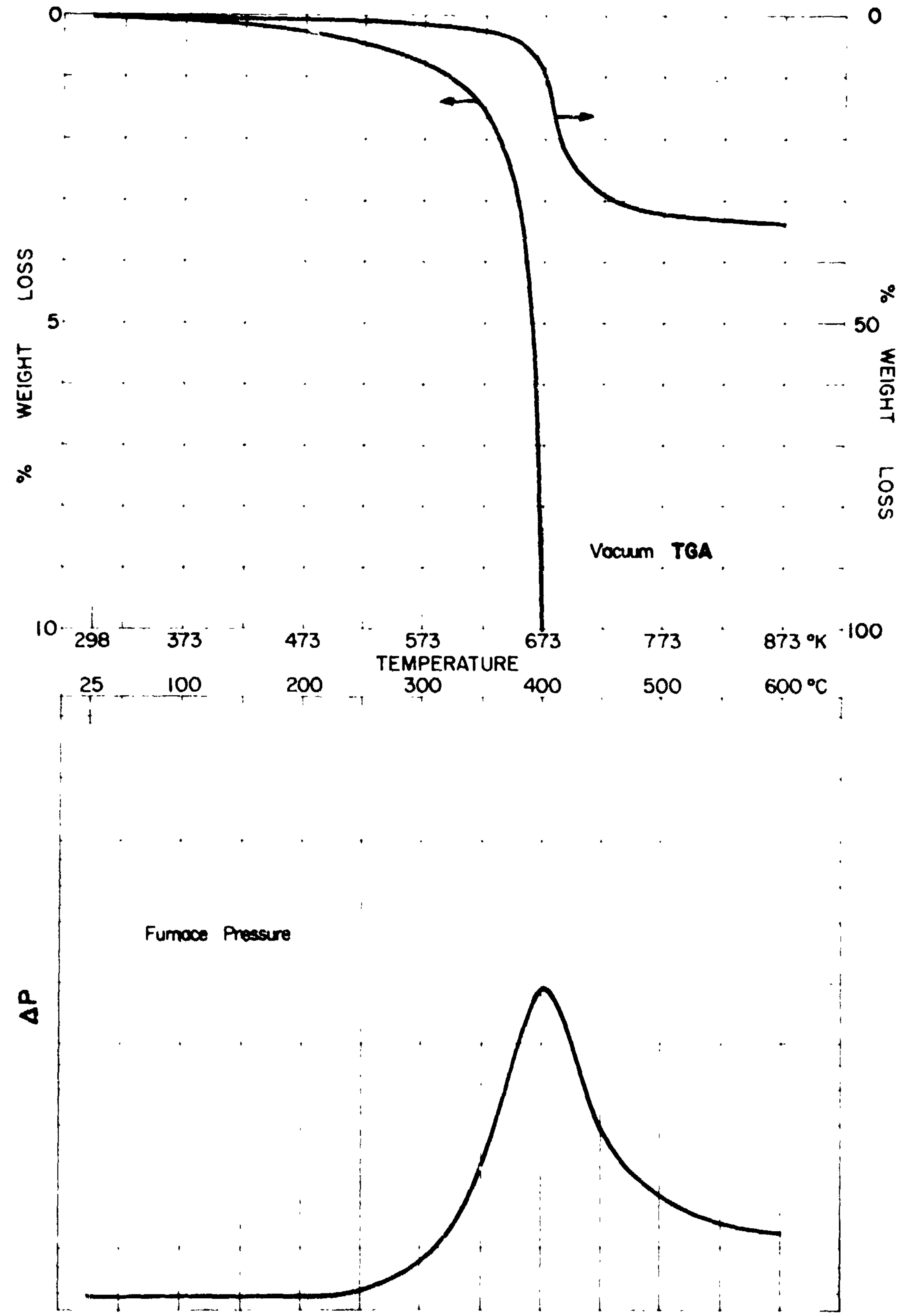
   a_o = of initial weight

   $$k = \quad \exp\left(\frac{-}{1.98\ T^{\circ}K}\right) \text{ min}^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	3.5×10^{7}	
100°C (373°K)	8.8×10^{5}	
150°C (423°K)	5.2×10^{4}	

Epo-Tek H72



E40

MASS NUMBER AND RELATIVE PEAK INTENSITY
TEMPERATURE, °C

m/e	[illegible]	200	350	425	475	550	
14	2215	2092	3017	8013	3507	3938	
15	733	748	2957	18038	5216	7549	
16	5229	4860	6872	13673	9264	12397	
17	20512	17473	23653	32296	17276	16569	
18	69435	58347	79472	101722	56435	53571	
19	592	606	702	1459	551	465	
20	396	30	566	898	556	494	
21							
22				66			
23		13					
24			186	965	236	138	
25	41	65	812	3571	1022	625	
26	377	529	3858	16012	4822	3140	
27	523	633	4511	19543	5588	3572	
28	25900	25471	35800	72616	38569	37009	
29	369	104	3374	23500	3410	2216	
30	379	371	873	4163	1249	1043	
31	135	143	832	8946	612	540	
32	6164	5817	5677	6259	5646	5542	
33				170			
34							
35							
36			108	691	152	118	
37			386	3253	870	560	
38			697	5422	1619	1055	
39	104	140	3121	17595	5445	3418	
40	3156	3158	4436	9962	5021	4749	
41	62	108	2563	10462	2196	1117	
42	54	78	1376	8039	1272	650	
43	81	146	3943	32003	2367	1545	
44	1562	2147	8616	14122	3220	2842	
45	57	63	967	5743	480	341	
46			68	404	86	61	
47				416	104	89	
48				176	41		
49			124	1109	359	208	
50			719	5289	2050	1304	
51			664	6012	2551	1632	
52			463	2593	1061	679	
53			669	4077	1659	990	
54			2353	1833	654	361	
55			577	3621	1113	662	
56			378	1591	279	157	
57			402	3866	193	114	
58			401	3530	159	99	
59			47	898	69		
60			208	980	153	69	
61				1096	287		
62			54	1529	576		
63			134	3093	1296		
64			67	1051	435		
65			322	4560	1793	[illegible]	
66	10	43	348	4168	1602	1226	
67			2725	2090	627	[illegible]	
68			227	656	207	121	
69			46	846	304	138	
70				240	44		
71				313	43		
72				451	53		
73			47	554	102	49	
74			100	1764	435	252	
75				713	220	97	
76				801	274	139	
77			288	4489	2171	1198	
78			220	2111	901	601	
79			566	[illegible]	1401	822	
80			236	992	447	229	
81			330	798	405	214	
82			2138	1029	464	257	
83			137	215	46	41	
84	62	94	124	284	137	121	
85				208			
86				295	53	42	
87				317	51		
88				66			
89				752	317	176	
90				733	348	221	
91		42	123	2599	1344	1321	
92			54	544	264	414	

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	200	350	425	475	550	
93			73	376	115	59	
94			206	4957	1798	1472	
95				582	178	113	
96				175			
97				50			
98				65			
99				61			
100				51			
101				92			
102				155			
103				383	172	70	
104				190	83		
105				603	278	225	
106				170	117	202	
107				4296	2042	994	
108			43	2546	1326	783	
109				234	88		
110				297	460	280	
111							
112							
113							
114				46			
115				308	90		
116				60			
117				95			
118				87			
119				160	40		
120				134	46		
121				742	351	57	
122				532	358	81	
123				118	103		
124				99	88		
125							
126							
127							
128				53			
129	64	72	95	192	141	95	
130				40			
131		52	58	315	142	90	
132	69	60	77	197	116	79	
133				66			
134				275	51		
135				85			
136				119	42		
137							
138							
139							
140							
141							
142							
143							
144							
145				101	45		
146							
147				588	109		
148				458	75		
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: 15 pbw of resin to 1 pbw of hardener
Cure: 1 hr at 105°C (383°K)

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: None (Room Ambient)
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 150°C-290°C (423°K-563°K)

a_o = 2% of initial weight

$$k = 1.3x10^5 \exp\left(\frac{-13300}{1.98\ T^{o}K}\right) \min^{-1}$$

In Nitrogen:

Over the range:

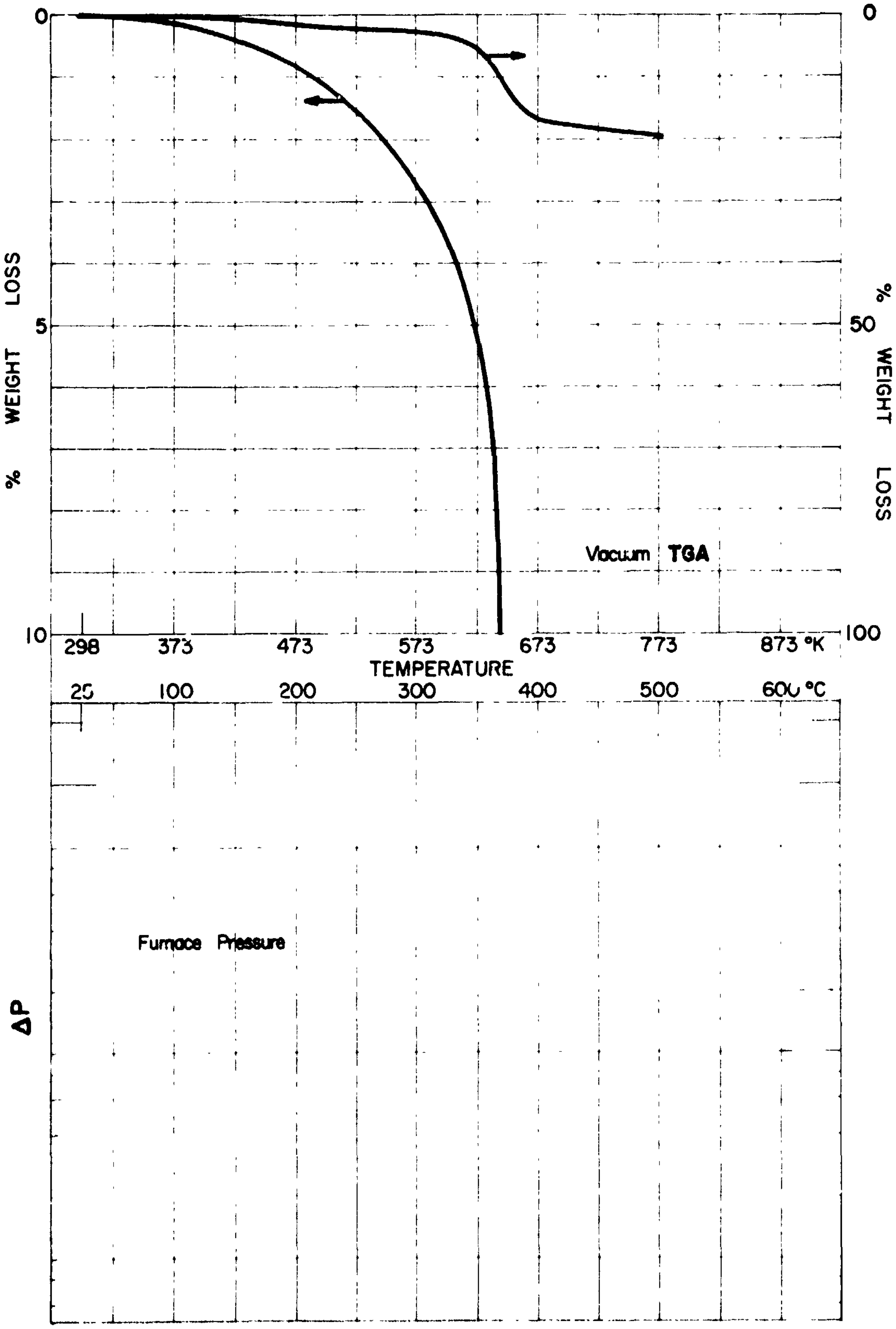
a_o = of initial weight

$$k = \exp\left(\frac{-}{1.98\ T^{o}K}\right) \min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	$5.2x10^3$	
100°C (373°K)	$3.2x10^2$	
150°C (423°K)	37	

Epo-Tek 417



E44

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	250	350	400	500		
14	993	1010	1393	1109	1161		
15	389	502	1761	1127	1048		
16	3443	3173	3635	2977	3190		
17	10160	8113	9371	7637	7172		
18	31594	23709	27951	21620	19856		
19	117	121	181	130	93		
20	201	181	203	182	179		
21							
22							
23							
24			59		72		
25		53	218	101	180		
26	111	238	1031	581	823		
27	303	544	2035	1368	847		
28	8225	8581	10114	8941	9190		
29	263	561	2618	1212	752		
30	830	896	924	848	852		
31	161	289	711	570	477		
32	2823	2635	2540	2419	2446		
33			45				
34							
35							
36			88	61			
37		46	545	349	88		
38		67	1027	704	147		
39		216	2943	2192	442		
40	1236	1281	1696	1724	1307		
41	51	187	765	497	290		
42	45	203	623	304	174		
43	81	173	1333	690	236		
44	612	821	2530	875	743		
45		70	169	107	55		
46			53	52			
47			140	122			
48			42				
49			178	124	45		
50		55	1073	612	141		
51		67	1385	866	167		
52		50	634	321	84		
53		47	879	502	88		
54			254	131	46		
55		60	536	442	101		
56		64	167	116	89		
57		44	234	110	56		
58			141	83			
59				51			
60			64	67			
61			216	167	43		
62			380	392	52		
63			796	619	95		
64			248	200	47		
65		49	1191	1061	132		
66		40	1235	1038	112		
67			150	140			
68			121	86			
69			73	44			
70			44				
71			60				
72			88	55			
73			247	174			
74			124	114			
75			121	88			
76		56	1565	872	130		
77		40	586	266	33		
78			1286	484	25		
79			487	145			
80			121	60			
81			50				
82							
83		47	65	44	41		
84							
85		42	50				
86			40				
87							
88			360	188			
89			597	195			
90		40	568	542	123		
91			114	105	44		
92							

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	250	350	400	500		
93			132	134	40		
94			1880	1456	110		
95			156	114			
96							
97							
98							
99							
100							
101							
102							
103			59	133			
104				47			
105			87	101			
106			54	51			
107			1498	585	82		
108			1736	437	70		
109			149	50			
110							
111							
112							
113							
114							
115			46	63			
116							
117							
118			41	41			
119			56	201			
120				68			
121			104	388			
122			43	85			
123							
124							
125							
126							
127							
128							
129	42	52	40	41			
130							
131			67	62			
132	41		64	49			
133			44	51			
134			59	167			
135				40			
136				76			
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

<u>Chemical Characterization Summary</u>

Mix ratio: Not available
Cure: Not available

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: None (Room Ambient)
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: $140^{o}C-480^{o}C$ ($413^{o}K-753^{o}K$)

a_o = 35% of initial weight

$$k = 4.5x10^{11} \exp\left(\frac{-\ 39000}{1.98\ T^{o}K}\right) \min^{-1}$$

In Nitrogen:

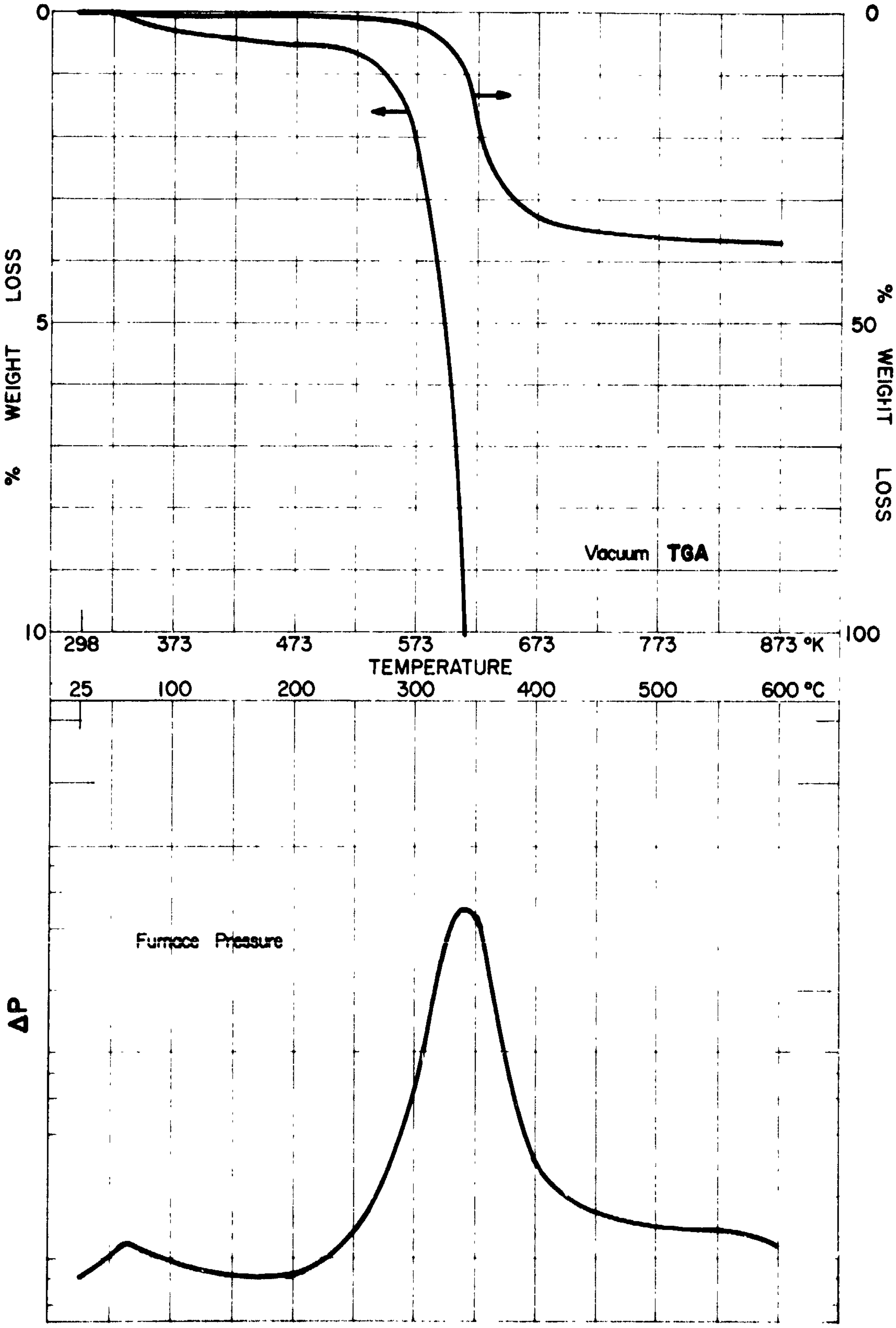
Over the range:

a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
$50^{o}C$ ($323^{o}K$)	$1.5x10^{11}$	
$100^{o}C$ ($373^{o}K$)	$1.2x10^{8}$	
$150^{o}C$ ($423^{o}K$)	$5.0x10^{5}$	



0
5
10
% WEIGHT LOSS
0
50
100
% WEIGHT LOSS
Vacuum TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
ΔP
Furnace Pressure

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	200	350	450	550		
14	2324	2530	6028	2866	3349		
15	374	546	10904	2120	3935		
16	3734	3984	11432	5106	7519		
17	14353	14292	26078	12146	11703		
18	47655	46583	75459	37776	36203		
19	1349	1305	1298	603	517		
20	326	325	591	364	359		
21							
22							
23							
24			1067	68	64		
25	45	68	3892	377	305		
26	271	452	19003	2130	1768		
27			20014				
28	26092	25778	51125	27361	27466		
29	319	614	9369	1342	945		
30	609	726	6738	1155	1083		
31	62	67	2684		109		
32	6443	6135	5923	5371	5356		
33							
34							
35							
36				40			
37			5081	239	84		
38			9894	500	195		
39		50	31971	2066	838		
40	984	996	13247	1500	1255		
41	44	61	7137	932	399		
42	40	51	7606	550	255		
43	65	124	5031	601	284		
44	774	991	7340	673	697		
45			1570	81	56		
46			482				
47			1477				
48			281				
49			1613	73			
50			7732	516	207		
51			9384	695	270		
52			3771	240	111		
53			5085	355	102		
54			1400	65	41		
55			5464	263	79		
56			1647	92	45		
57			732	57			
58			1123	49			
59			555				
60			400				
61			157[illegible]	54			
62			2944	113	44		
63			5907	311	104		
64			2054	99	50		
65			13446	542	179		
66			1441[illegible]	491	153		
67			2546	85	41		
68			231	46			
69			187				
70			217				
71			164				
72			134				
73			449				
74			1366	48			
75			841				
76			607				
77			6201	547	172		
78			1849	138	67		
79			2684	217	69		
80			1147	71			
81			422				
82			154				
83			59				
84			115	47			
85			75				
86			118				
87			117				
88							
89			910	51			
90			496	45			
91			5030	350	161		
92			711	44			

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	200	350	450	550		
93			1139	48			
94			15669	437	100		
95			1218				
96			76				
97							
98			44				
99							
100							
101			70				
102			131				
103			977	59			
104			102				
105			602	45			
106			123				
107			2701	299	69		
108			105	100	40		
109			104				
110							
111							
112							
113							
114							
115			49				
116			204				
117			94				
118			638				
119				54			
120			275				
121			2356	97			
122			402	41			
123							
124							
125							
126							
127							
128							
129			[illegible]				
130							
131							
132			[illegible]				
133			[illegible]				
134			547				
135			[illegible]				
136			[illegible]				
137			117				
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: as received
Cure: 1 hr at 350°F (450°K)

1. Isothermal Weight loss in Nitrogen: 1.23%

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 180°C - 400°C (453°K-673°K)

a_o = 59% of initial weight

$$k = 8.2\times10^{8} \exp\left(\frac{-28600}{1.98\ T^{o}K}\right) \ \mathrm{min}^{-1}$$

In Nitrogen:

Over the range:

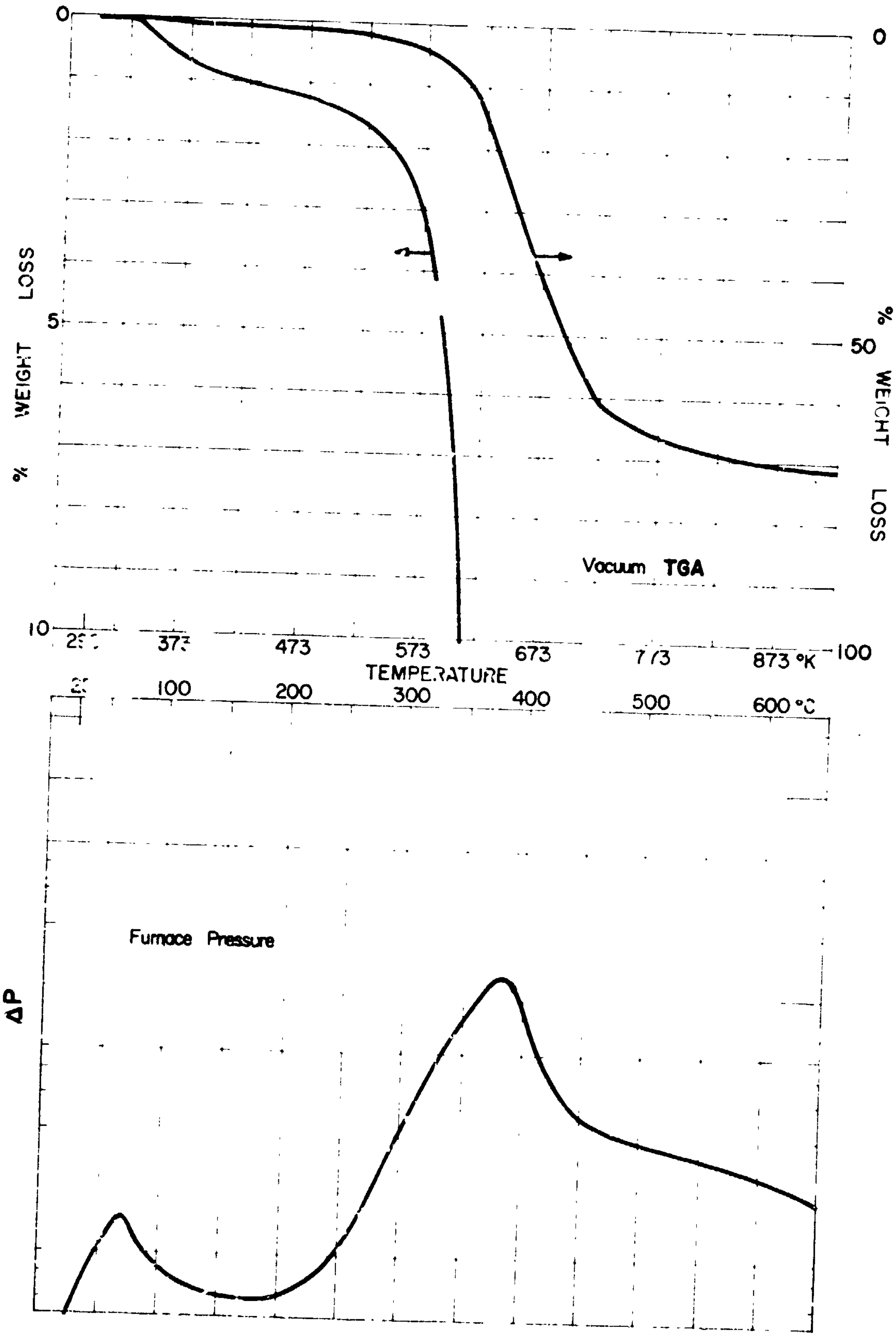
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \ \mathrm{min}^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	2×10^{10}	
100°C (373°K)	5×10^{7}	
150°C (423°K)	4.8×10^{5}	

FM-40



0
5
10
% WEIGHT LOSS
0
50
100
% WEIGHT LOSS
Vacuum TGA
373
473
573
673
873 °K
TEMPERATURE
100
200
300
400
500
600 °C
Furnace Pressure
ΔP

E52

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	200	400	500	650		
14	270	3750	853	5814	6230		
15	34	2675	1806	11581	13981		
16	1004	10797	2968	21140	26318		
17	3162	34010	5912	28033	30740		
18	9727	84673	16428	75686	83260		
19		506		344	197		
20		736	52	827	816		
21							
22		59					
23							
24		41	65	472	105		
25		148	413	1822	482		
26		1194	2184	9120	2736		
27	73	2574	2761	11350	4256		
28	4349	43520	9085	31613	56830		
29		1137	2199	3096	2121		
30	143	2510	943	3007	2650		
31		121	405	644	266		
32	345	9080	933	8167	8497		
33				152	46		
34				313	125		
35							
36			45	290	76		
37		43	710	1994	236		
38		113	1407	3876	456		
39		326	4693	12495	1416		
40	630	7136	2321	10723	2154		
41		372	1462	3509	983		
42		356	1011	1979	695		
43		621	1920	2712	1098		
44	172	8669	4696	4979	5056		
45		125	274	561	227		
46				160			
47			104	398			
48		61		251			
49			245	923	99		
50		137	1391	4714	551		
51		121	1725	6469	675		
52		107	682	2653	370		
53			1058	3641	259		
54		41	260	910	126		
55		61	871	2078	429		
56		42	173	394	198		
57			111	226	82		
58			15	204	61		
59				101			
60			33	567			
61			225	937	47		
62			466	1545	91		
63			963	3285	246		
64		105	296	1150	114		
65		52	1979	4911	390		
66		85	2253	4876	339		
67			332	747	127		
68			152	480	64		
69			171	122			
70			119	87			
71				50			
72				129			
73			42	225			
74			227	900	68		
75			100	551	58		
76			77	475	46		
77			1644	6679	414		
78		64	527	2423	505		
79			953	4150	189		
80			387	1339	48		
81			117	394			
82				199			
83				54			
84		114		181	169		
85				60			
86				147			
87				101			
88							
89			156	971			
90			216	1312			
91			730	3545	350		
92			119	761	139		

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	250	400	500	650		
93			219	580			
94			2964	5718	385		
95			228	396			
96				44			
97							
98							
99							
100							
101							
102				128			
103			93	508			
104				218			
105			[illegible]	811			
106				463			
107			1633	7399	290		
108			974	4712	115		
109			49	314			
110							
111							
112							
113							
114							
115				[illegible]			
116				92			
117				180			
118				90			
119			[illegible]	145			
120				157			
121			313	1030	57		
122			274	1504			
123				90			
124							
125							
126							
127							
128				51			
129		115		176	135		
130							
131		67		207	105		
132		109		212	147		
133							
134				31			
135				115			
136				[illegible]			
137							
138							
139							
140							
141							
142							
143							
144							
145				[illegible]			
146							
147				78			
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: 100 pbw of resin to 5 pbw of catalyst
Cure: 1½ hr at 300°F (422°K)

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 25°C-315°C (298°K-583°K)

a_o = 33% of initial weight

$$k = 4.6 \quad \exp\left(\frac{-\ 6510}{1.98\ T^{\circ}K}\right) \quad \min^{-1}$$

In Nitrogen:

Over the range:

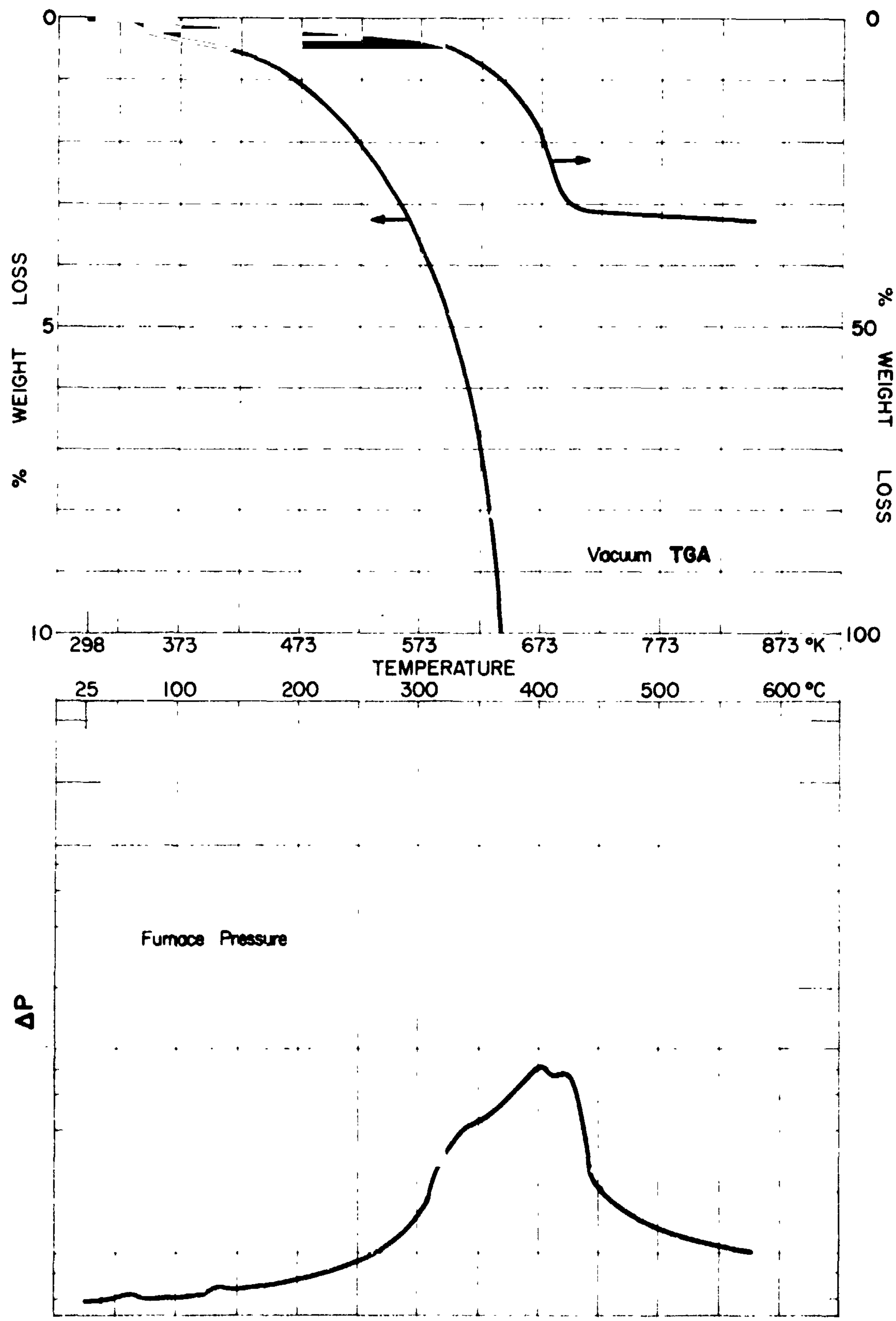
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{\circ}K}\right) \quad \min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	3.5×10^3	
100°C (373°K)	8.8×10^2	
150°C (423°K)	3.1×10^2	

M-9-N/Catalyst A



MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	150	350	400	500		
14	2303	2459	4675	5155	2941		
15	838	1360	9896	7634	2994		
16	4883	4873	7000	7702	5891		
17	18080	15920	19980	19682	12519		
18	60310	51563	62992	64094	39911		
19	1385	1622	1547	1261	820		
20	458	397	539	594	432		
21							
22							
23	97	97					
24			365	677	62		
25	44	94	1538	2505	451		
26	539	825	7992	11252	2457		
27	836	1138	10334	10749	2836		
28	28303	28666	45202	45853	29451		
29	695	860	6728	9376	1843		
30	436	716	5614	2155	790		
31	947	1087	2443	2657	1435		
32	6915	6352	5794	6086	5382		
33				176			
34							
35							
36			158	440			
37			953	3501	293		
38			1996	6438	594		
39	103	160	5261	19093	2325		
40	3113	3262	6662	11153	3828		
41	66	175	3916	3238	934		
42	60	592	11305	3613	961		
43	130	469	6577	10264	1120		
44	1131	1918	10829	4104	1301		
45	323	598	4143	1451	695		
46	73	88	265	457	141		
47			176	1355			
48				155			
49			315	1237	90		
50		73	1553	5249	740		
51			1395	5349	920		
52			919	1687	317		
53			991	3088	333		
54			660	604	53		
55			1740	4900	305		
56			2770	1385	142		
57			1454	587	85		
58		598	7640	1956	193		
59		185	1879	174			
60			193	461			
61			169	1333	55		
62			301	[illegible]19	178		
63			645	4340	450		
64			275	1419	123		
65			1916	11082	811		
66			2540	13876	746		
67			572	1313	83		
68			411	494			
69			157	97			
70			443	73			
71			491				
72			198	71			
73			271	322			
74			133	1131	81		
75			55	571			
76			41	452	41		
77			452	3914	720		
78			323	1270	450		
79			366	1848	286		
80			452	370	53		
81			237	102			
82			222	64			
83			92				
84	51	69	329	136	72		
85			182				
86			55	62			
87			65	49			
88							
89				575	57		
90				499	42		
91			223	2870	868		
92			74	450	187		

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	150	350	400	500		
93			197	859			
94			4507	20513	991		
95			419	1340			
96				52			
97							
98							
99							
100							
101							
102				76			
103				655	58		
104				68			
105				428	156		
106				47	41		
107			369	2674	373		
108			362	1194	167		
109							
110							
111							
112							
113							
114							
115				266	43		
116							
117				82			
118				77			
119				1150	80		
120				232			
121			77	2599	142		
122			54	535			
123							
124							
125							
126							
127							
128							
129	[illegible]	[illegible]	82	134	82		
130							
131		43	95	319	93		
132	[illegible]	69	111	217	98		
133				233			
134			51	976	47		
135				111			
136				[illegible]			
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: As received
Cure: As received

1. Isothermal Weight loss in Nitrogen: 0.15%

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 300°C-400°C (573°K-673°K)

a_o = 10% of initial weight

$$k = 1.6\times10^{34} \exp\left(\frac{-98000}{1.98\ T^{\circ}K}\right) \min^{-1}$$

In Nitrogen:

Over the range:

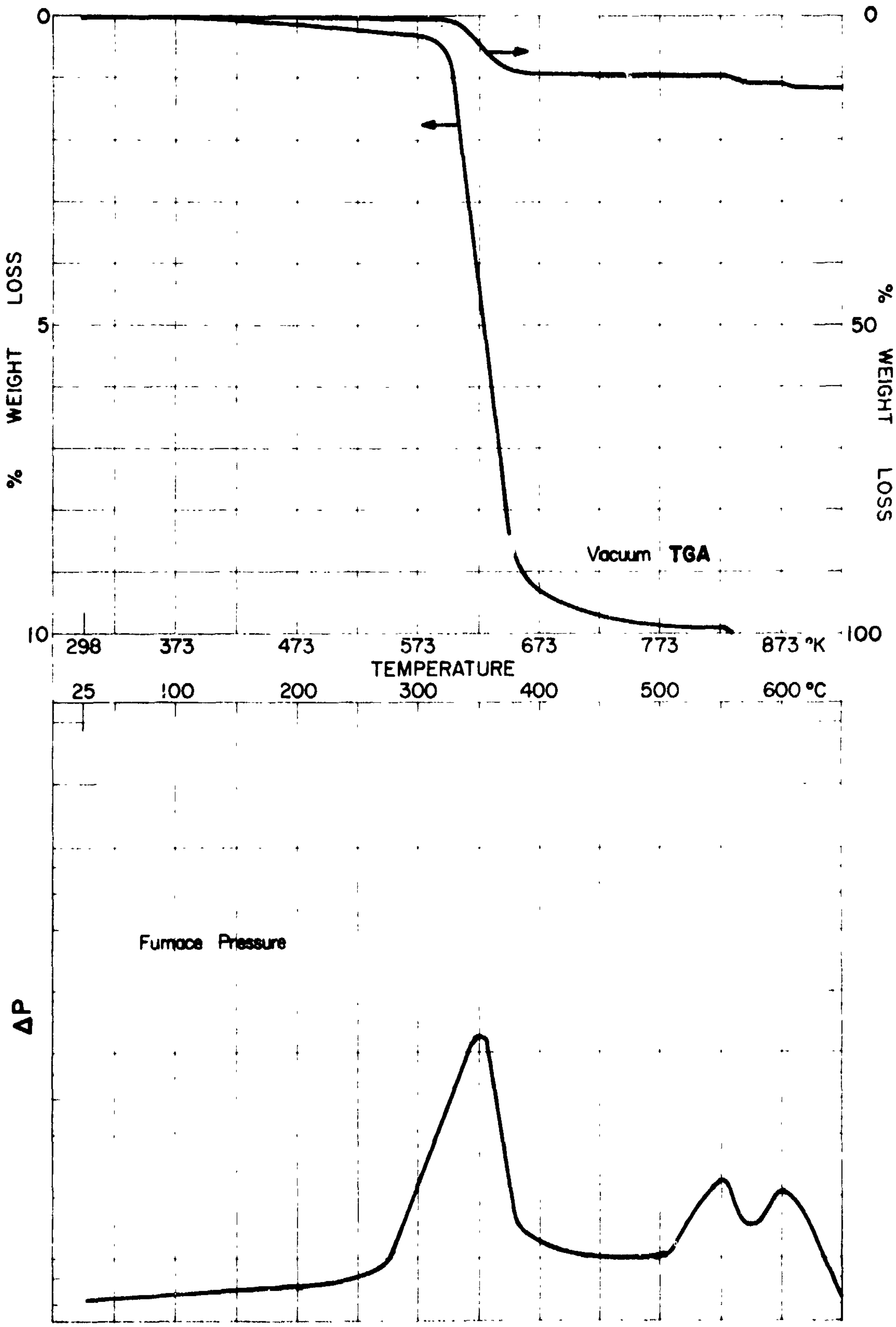
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{\circ}K}\right) \min^{-1}$$

Time to % Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	1.5×10^{32}	
100°C (373°K)	1.8×10^{23}	
150°C (423°K)	2.3×10^{16}	

MF500F-124 Microwave Absorber



MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	200	325	350	425	600	
14	3665	3609	5188	6977	3645	14412	
15	1758	1914	6625	11999	2691	2051	
16	12791	11836	13976	16109	11762	11340	
17	41235	34062	36223	17133	29616	17750	
18	100799	100254	100843	100855	83628	75849	
19	294	293	469	562	186	141	
20	853	846	881	935	706	829	
21							
22							
23							
24			533	1011	44		
25	89	99	2099	4038	389	159	
26	898	1209	10028	18363	2563	1916	
27	1923	2201	10618	20259	3347	3842	
28	43992	42441	62238	63998	43814	100918	
29	635	720	7369	12470	1525	1631	
30	2219	2267	3431	3992	2226	2566	
31		51	3379	2702	164	45	
32	10125	9372	8743	8964	8224	8569	
33			118	70			
34							
35							
36			388	818			
37			3155	6521	423		
38		56	5670	12729	1018	61	
39	148	326	17201	43732	3556	385	
40	7732	7354	14968	22343	8490	8868	
41	124	512	7369	9931	1226	362	
42	75	637	7757	5818	718	185	
43	148	383	6981	9628	877	314	
44	2365	2908	13648	7115	2392	2531	
45			1884	1229	63		
46			496	596			
47			1309	1935	59		
48			184	280			
49			1203	2110	91		
50			4907	10679	912		
51			4034	12580	1010	60	
52			1351	3803	516		
53			2453	6911	546		
54			639	1017	54		
55			4628	8168	592		
56			925	970	73		
57			2076	1522			
58			1538	1343			
59			169	551			
60			348	368			
61			1409	2334	[illegible]		
62			2166	4703	241		
63			3981	9331	65		
64			1365	3003	155		
65			12489	21886	1648		
66	16		17004	21863	1707	[illegible]	
67			1529	2370	142		
68			927	917			
69			317	156			
70			198	136			
71			376	65			
72			144				
73			356	526			
74			1098	2356	[illegible]		
75			499	1483			
76			378	924			
77			3160	11630	923		
78			731	2752	296		
79			99	3393	386		
80			209	313			
81			116	248			
82			71	47			
83			41				
84	88	83	180	122	55	86	
85							
86			92	157			
87				136			
88							
89			146	1557	40		
90			81	624			
91			1348	11075	672		
92			235	1341			

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	200	325	350	425	600	
93			944	2177	49		
94			26761	23694	2163		
95			1692	1761	52		
96			80	53			
97							
98		63	1417	222			
99		85	1799	245			
100			46				
101				124			
102				283			
103			410	2817	64		
104				274			
105			179	1445	41		
106				129			
107			614	3018	473		
108			231	476	167		
109							
110							
111							
112							
113							
114							
115			81	635			
116				55			
117				176			
118			41	212			
119			436	5269	186		
120			60	831			
121			2172	9899	401		
122			238	929			
123							
124							
125							
126							
127							
128							
129	119	126	93	84	88	112	
130							
131	68	90	96	193	74	47	
132	96	104	105	114	82	77	
133			51	224			
134			456	3962	128		
135				426			
136			378	1501			
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: 100 pbw resin to 12 pbw hardener
Cure: 4 hrs at 150°F (338°K) plus 3 hrs at 275°F (408°K)

1. Isothermal Weight loss in Nitrogen: 0.05%

2. Steady-State Vacuum Condensible Degassing Rate: 4.37×10^{-6}%/day

3. TGA Conditioning:

TGA Vacuum: 100 hr at 125°C (325°K) in N_2 atmosphere
Nitrogen: 24 hr at 23°C (296°K) and 45% RH

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 300°C-550°C (573°K-823°K)

a_o = 72% of initial weight

$$k = 1.3\times10^{27} \exp\left(\frac{-82000}{1.98\ T^{\circ}K}\right) \ \min^{-1}$$

In Nitrogen: Not amenable to analysis

Over the range:

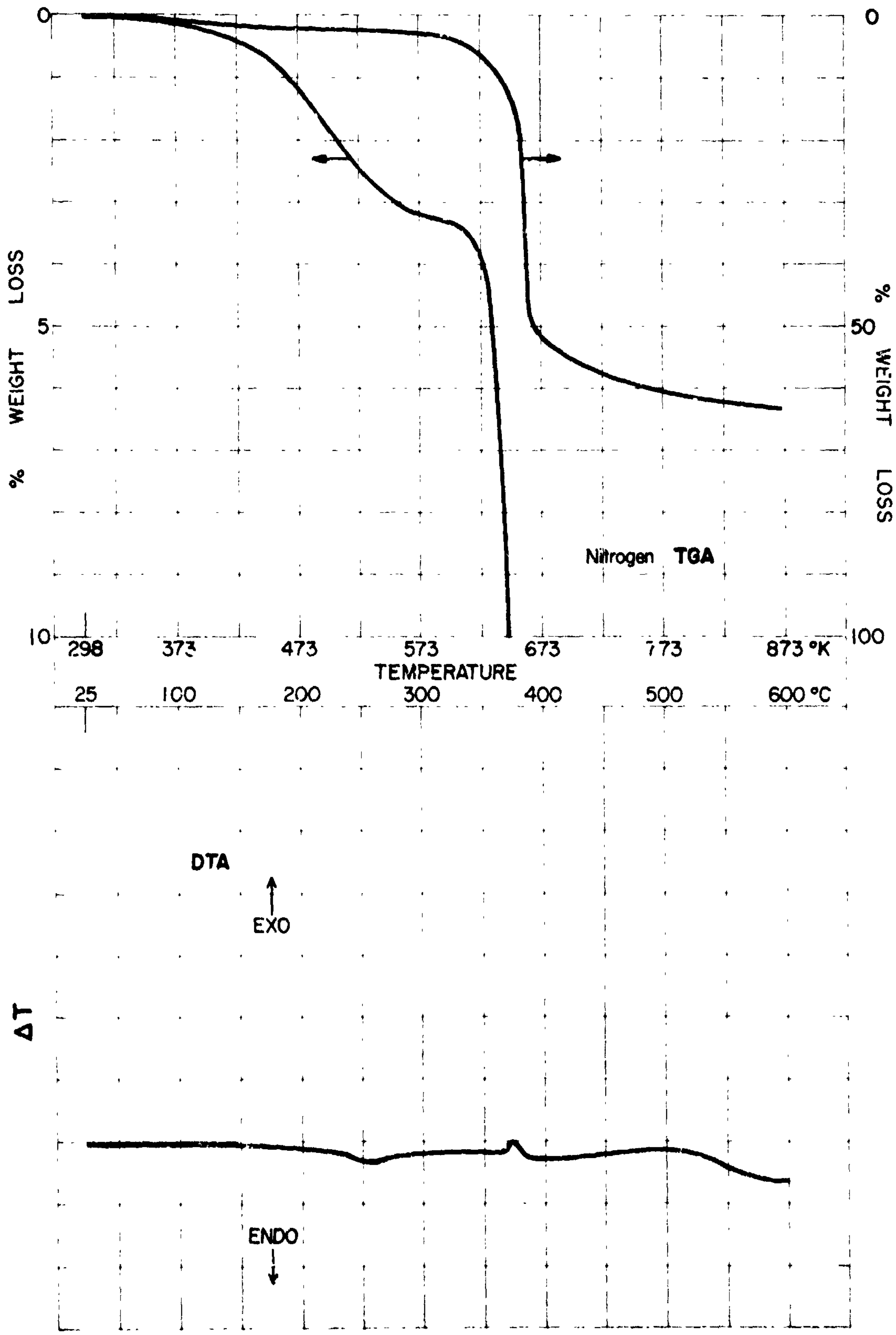
a_o = of initial weight

$$k = \exp\left(\frac{-}{1.98\ T^{\circ}K}\right) \ \min^{-1}$$

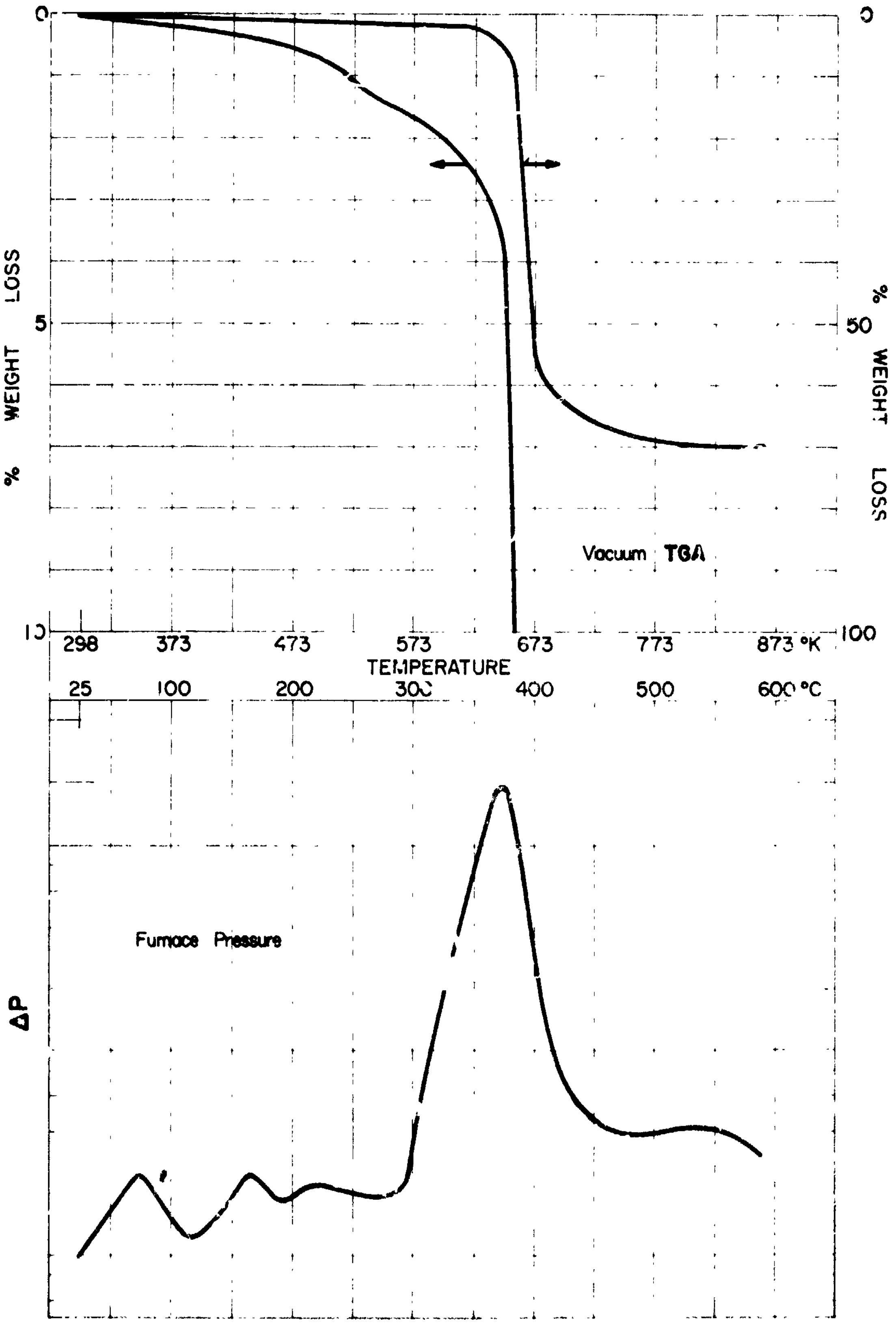
Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	2.5×10^{28}	
100°C (373°K)	8.3×10^{20}	
150°C (423°K)	1.4×10^{15}	

Stycast 1090/Cat. 11



E64


% WEIGHT LOSS
% WEIGHT LOSS
Vacuum TGA
TEMPERATURE
298 373 473 573 673 773 873 °K
25 100 200 300 400 500 600 °C
Furnace Pressure
ΔP

Stycast 1090/Cat. 11

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	300	361	386	425	575	
14	[illegible]	391	3700	3635	872	1255	
15	[illegible]	487	8438	9152	2002	3656	
16	539	811	8584	6699	2049	5121	
17	7638	5899	24763	20771	7248	5836	
18	28653	22644	90602	73390	26276	20924	
19	28	21	176	247	45		
20	35	29	96	71	43	28	
21							
22			85	21			
23							
24			373	505	83	27	
25		45	2123	2610	390	152	
26		422	9701	13326	3044	1171	
27	42	698	8770	16037	3472	1406	
28	7870	9747	29529	25775	12074	19126	
29	47	307	14171	11546	1746	395	
30	23	76	662	715	135	152	
31		29	2596	2389	207	37	
32	1775	1490	2076	2140	1406	3186	
33			22		22		
34			22	21			
35							
36			273	357	44		
37		29	4046	5696	493	50	
38		37	7437	11256	1439	121	
39		222	23231	38834	6190	662	
40	118	226	10039	13216	1689	211	
41		606	5065	6346	1273	188	
42		1155	5675	3526	399	82	
43	23	288	7862	6872	1203	143	
44	151	1961	29224	6583	755	254	
45		20	1342	965	70	25	
46			314	243	32		
47			1693	1688	83		
48			124	141	23		
49			1039	1444	144	30	
50		27	6007	9010	1237	116	
51			5582	11183	2089	211	
52		22	1412	3101	402	77	
53			3774	6031	868	79	
54		22	329	604	95	26	
55		20	5363	7055	678	52	
56		60	382	277	74	27	
57			304	362	49		
58		21	285	331	61		
59			67	214	43		
60			188	351	34		
61			1301	1710	156	24	
62			2334	3579	316	46	
63			4751	7656	1019	77	
64			1190	2122	237	29	
65			13204	17449	2272	102	
66			17343	17723	2021	103	
67			1092	1542	124		
68			395	391	49		
69			63	98	23		
70		31	46	37			
71		23	28				
72			30	42			
73			184	220	32		
74			692	1383	143	21	
75			331	847	61		
76			169	327	67		
77			2306	6273	1245	84	
78			503	1338	215	46	
79			865	2320	321	44	
80			116	177	43		
81			41	81	31		
82			35	29			
83							
84				29			
85			20	24			
86			25	40			
87			30	62			
88							
89			189	600	55		
90			148	189	46		
91			1095	4167	527	93	
92			124	255	39	22	

C - 2

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	300	361	386	425	575	
93			225	349	49		
94			13753	11843	969	32	
95			623	440	39		
96			22	31			
97							
98		65					
99		40	39				
100							
101				30			
102				23			
103			57	200	26		
104				23			
105			35	130	23		
106				26			
107			169	453	123	33	
108			41	93	25		
109							
110							
111							
112							
113							
114							
115				20			
116							
117							
118							
119			62	289	27		
120				25			
121			83	125	22		
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Table 1. Dielectric Constant* (ASTM D150-68) @ 1 KHz

Exposure	Average	High	Low	Samples Tested
Baseline	2.89	2.94	2.84	3
Heat Compatibility (1)	2.82	2.85	2.79	3
Thermal Vacuum (2)	2.75	2.83	2.65	3

*Cured 4 hr at 150°F (338°K) plus 3 hr at 275°F (408°K)

(1) 383 hr at 275°F (408°K) in N_2 atmosphere

(2) Tested at $1x10^{-5}$ Torr after 750 hr at 150°F (338°K) at $1x10^{-6}$ Torr preceded by heat compatibility

Chemical Characterization Summary

Mix ratio: not available
Cure: not available

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 130°C-315°C(403°K-588°K)

a_o = 92% of initial weight

$$k = 1.02\times10^{3} \exp\left(\frac{-13700}{1.98\ T^{\circ}K}\right) \ min^{-1}$$

In Nitrogen:

Over the range:

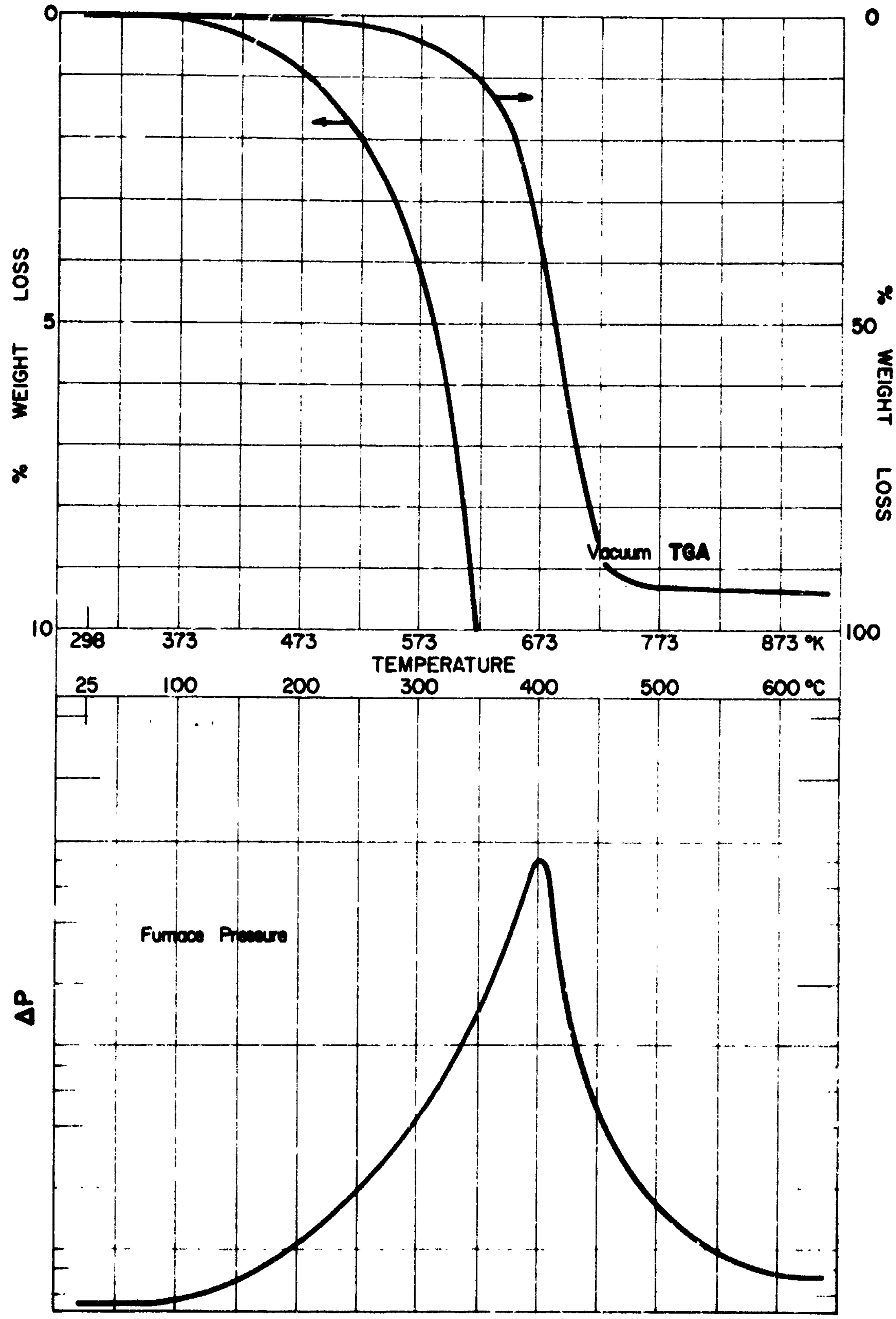
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{\circ}K}\right) \ min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	1.2×10^{6}	
100°C (373°K)	6.8×10^{4}	
150°C (423°K)	7.4×10^{3}	

Stycast 1263/Cat. 31



MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	150	300	400	550		
14	1503	1447	2160	832	2838		
15	447	749	3318	4082	5987		
16	4831	4370	5115	2122	10627		
17	21815	19588	17753	6175	17366		
18	72785	66025	56330	20797	53319		
19	259	251	182		120		
20	548	500	559		662		
21							
22							
23							
24			545	189	157		
25		187	2276	1455	783		
26	253	1473	13898	11175	4737		
27	662	2404	25442	28598	6963		
28	73601	24746	48973	28614	39069		
29	346	760	8456	9364	2826		
30	1024	1159	1493	556	2254		
31		82	521	497	196		
32	4892	4322	4161	463	4713		
33							
34							
35							
36		50	370	92	191		
37		88	2139	1824	458		
38		221	4358	4704	1071		
39		2265	28706	35638	5519		
40	5329	5967	11684	7988	8298		
41	57	1547	20493	26010	3309		
42	44	181	2546	3093	716		
43	97	218	2644	4959	1145		
44	1283	2251	7772	8876	2947		
45		52	628	997	192		
46			78				
47			239	47	49		
48			78				
49		41	796	632	196		
50		379	4631	5406	1565		
51		488	5535	7467	1937		
52		222	3426	4734	932		
53		542	7315	10482	1328		
54		2651	33346	51355	3640		
55		269	7711	7262	906		
56		42	3770	2265	194		
57			1523	799	140		
58			80	502	55		
59							
60			47				
61			277	135	111		
62			637	588	263		
63		53	1299	1796	672		
64			333	385	161		
65		114	3869	4140	1179		
66		136	4828	4541	816		
67		3047	36062	57640	3668		
68		109	2609	3690	224		
69			846	324	67		
70			593	68			
71			174				
72							
73			94	456	127		
74			338	429	167		
75			131	67	67		
76			131	102	125		
77		146	1903	3267	1517		
78		73	785	1057	575		
79		256	5429	4750	960		
80		92	1244	1472	262		
81		215	3322	4826	324		
82		2429	28572	43128	2843		
83		106	2143	2774	133		
84			239				
85			53				
86							
87					40		
88				147	45		
89					123		
90					118		
91			91	515	1402		
92			44		235		

Stycast 1263/Cat. 31

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	150	300	400	550		
93					60		
94			3612	2123	594		
95			231				
96							
97			48				
98							
99							
100							
101							
102							
103					87		
104					40		
105			51		345		
106					112		
107			53	298	732		
108			[illegible]	324	338		
109							
110			102				
111							
112							
113							
114							
115					48		
116							
117							
118							
119					40		
120					42		
121				148	148		
122					80		
123							
124							
125							
126							
127							
128							
129							
130							
131			41		41		
132							
133							
134							
135					41		
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: 100 pbw of resin to 3 pbw of hardener.
Cure: 4 hrs at 270°F (405°K)

1. Isothermal Weight loss in Nitrogen: 0.09%

2. Steady-State Vacuum Condensible Degassing Rate: 1.679×10^{-5} %/da,

3. TGA Conditioning:

TGA Vacuum: 100 hr at 125°C (398°K) in N_2 atmosphere.
Nitrogen: 24 hr at 23°C (296°K) and 45% RH

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 250°C -340°C (523°K - 613°K)

a_o = 9% of initial weight

$$k = 2\times10^{21} \exp\left(\frac{-61500}{1.98\ T^{\circ}K}\right) \min^{-1}$$

In Nitrogen:

Over the range: 250°C - 350°C (523°K - 623°K)

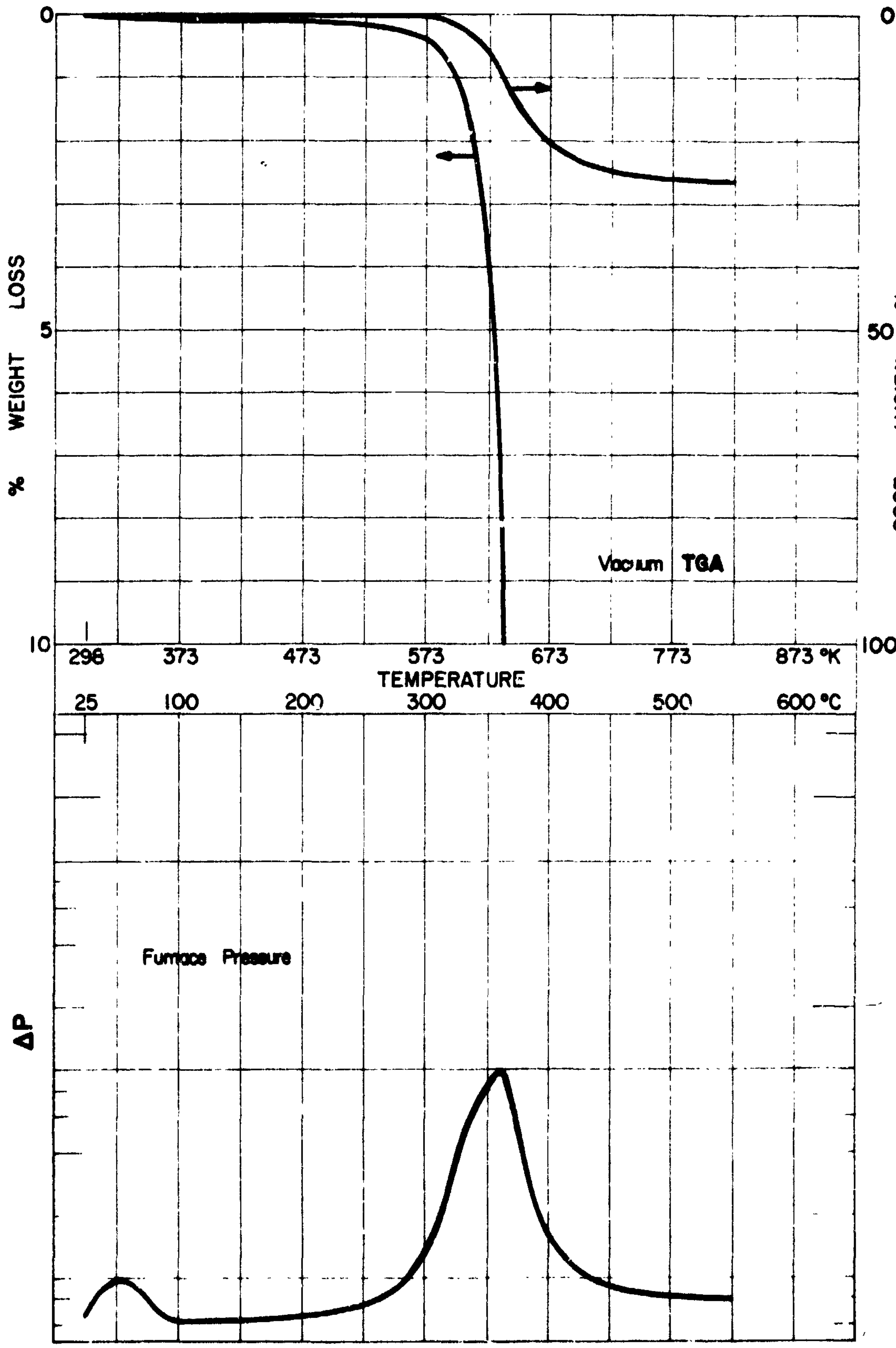
a_o = 20% of initial weight

$$k = 8.5\times10^{18} \exp\left(\frac{-55300}{1.98\ T^{\circ}K}\right) \min^{-1}$$

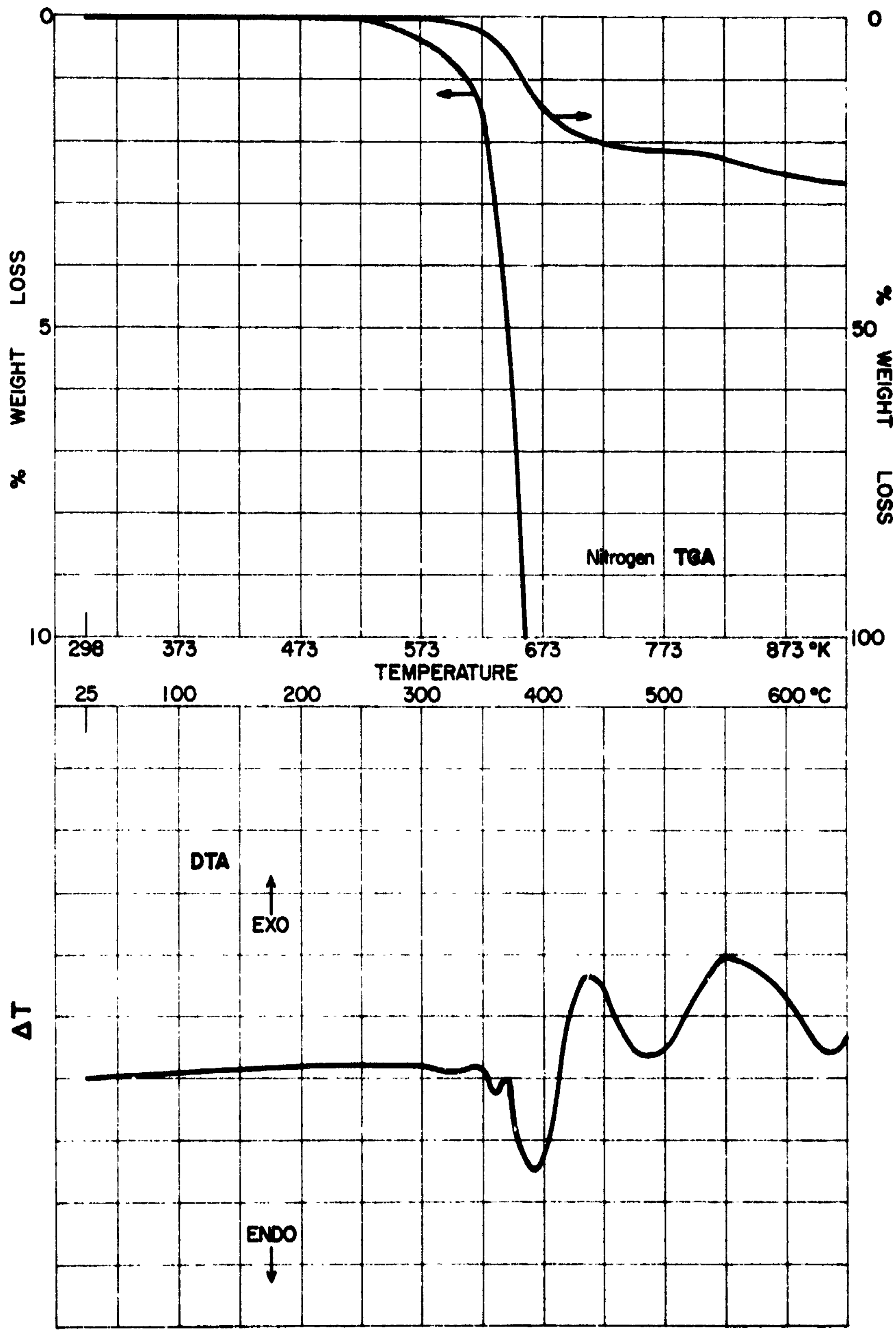
Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	1.9×10^{20}	2.7×10^{18}
100°C (373°K)	4.7×10^{14}	2.5×10^{13}
150°C (423°K)	2.2×10^{10}	3.3×10^{9}

Stycast 2850 FT/Cat.9



E74



0
5
10
% WEIGHT LOSS
0
50
100
% WEIGHT LOSS
Nitrogen TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
DTA
EXO
ENDO
ΔT

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, ^{o}C

m/e	25	200	300	375	425	500	
14	464	525	588	917	666	661	
15	92	123	258	1251	447	369	
16	2159	2245	2368	2765	2265	2372	
17	8440	7767	8286	8559	7456	2555	
18	27718	24682	25874	25982	22286	22454	
19			55	47			
20	48	47	61	92	3	72	
21							
22							
23							
24				48			
25				237	64		
26			207	1795	487	236	
27		85	349	2062	630	363	
28	6681	6847	7468	10083	7764	7750	
29	40	54	304	1702	426	208	
30	349	413	468	1067	560	537	
31			70	439	54		
32	1626	1633	1610	1460	1480	1568	
33							
34							
35							
36							
37				203	53		
38				492	135		
39			106	1803	607	132	
40	741	824	900	1607	1108	996	
41			166	968	185	101	
42			75	1098	144	68	
43			159	1148	351	101	
44	171	212	539	1113	317	247	
45				108	108		
46							
47				40			
48							
49				51			
50				350			
51				390	118		
52				156			
53				243	61		
54				105			
55				321	81		
56			67	442	40		
57				150			
58				102			
59							
60							
61							
62				62			
63				187	68		
64				49			
65				547	176		
66				718	175		
67				91			
68				50			
69							
70				41			
71							
72							
73							
74							
75							
76							
77				111	64		
78				49			
79				55			
80				66			
81							
82							
83							
84							
85							
86							
87							
88							
89							
90							
91				48			
92							

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	200	300	375	425	500	
93							
94				850	170		
95							
96							
97							
98							
99							
100							
101							
102							
103							
104							
105							
106							
107				43			
108							
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Stycast 2850 FT/Cat. 11

Chemical Characterization Summary

Mix ratio: 100 pbw of resin to 4.5 pbw of catalyst II.
Cure: 4 hrs at 165°F (347°K) followed by 4 hrs at 270°F (405°K).

1. Isothermal Weight loss in Nitrogen: 0.06%

2. Steady-State Vacuum Condensible Degassing Rate: 1.26×10^{-5}%/day

3. TGA Conditioning:

TGA Vacuum: 100 hrs at 125°C (398°K) in N_2 atmosphere
Nitrogen: 24 hrs at 23°C (296°K) and 45% RH.

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 340°C - 500°C (613°K - 773°K)

a_o = 24% of initial weight

$$k = 7.9\times10^{37} \exp\left(\frac{-113000}{1.98\ T^{\circ}K}\right) \quad \min^{-1}$$

In Nitrogen:

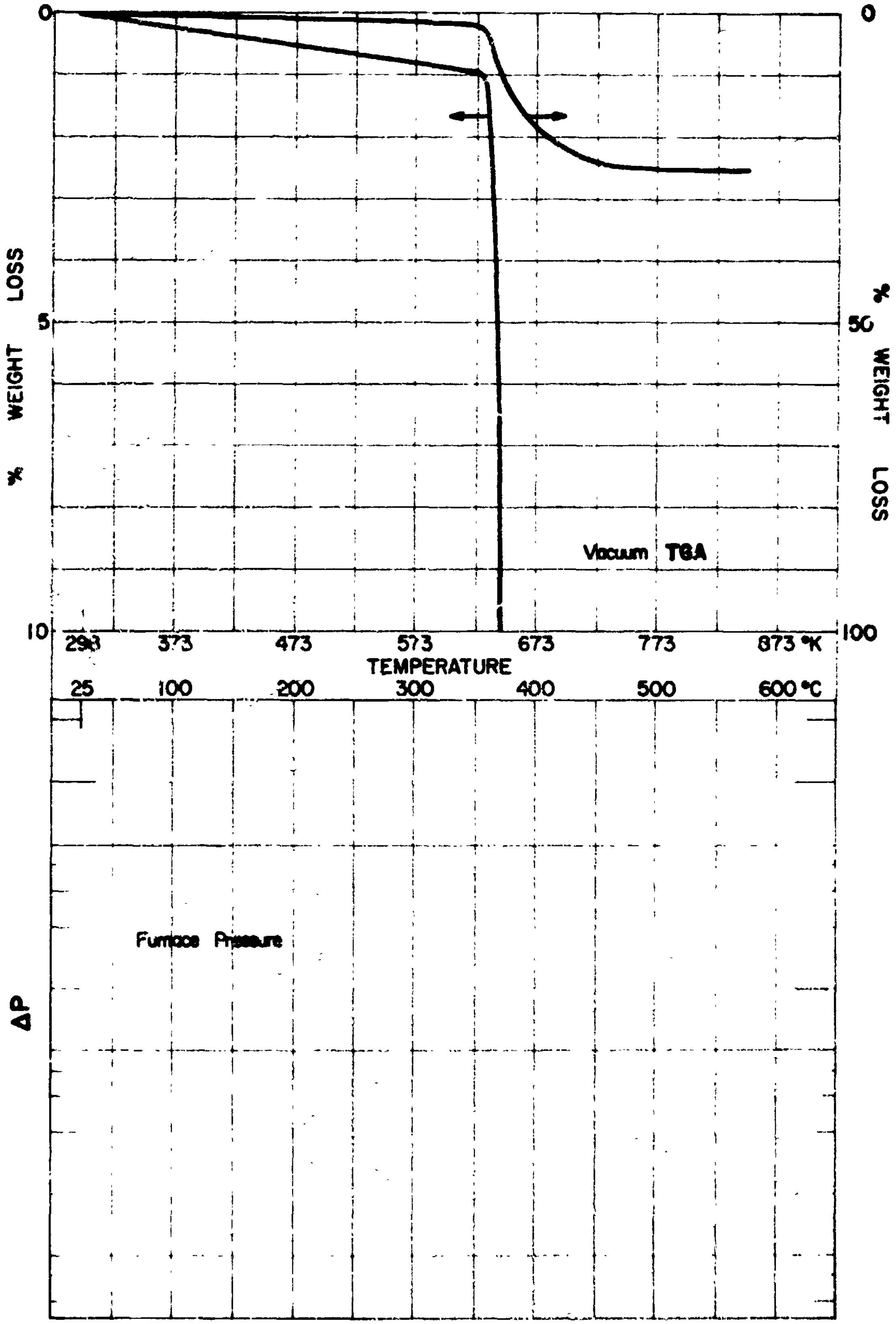
Over the range: 240°C - 500°C (573°K - 773°K)

a_o = 19% of initial weight

$$k = 2.2\times10^{45} \exp\left(\frac{-135000}{1.98\ T^{\circ}K}\right) \quad \min^{-1}$$

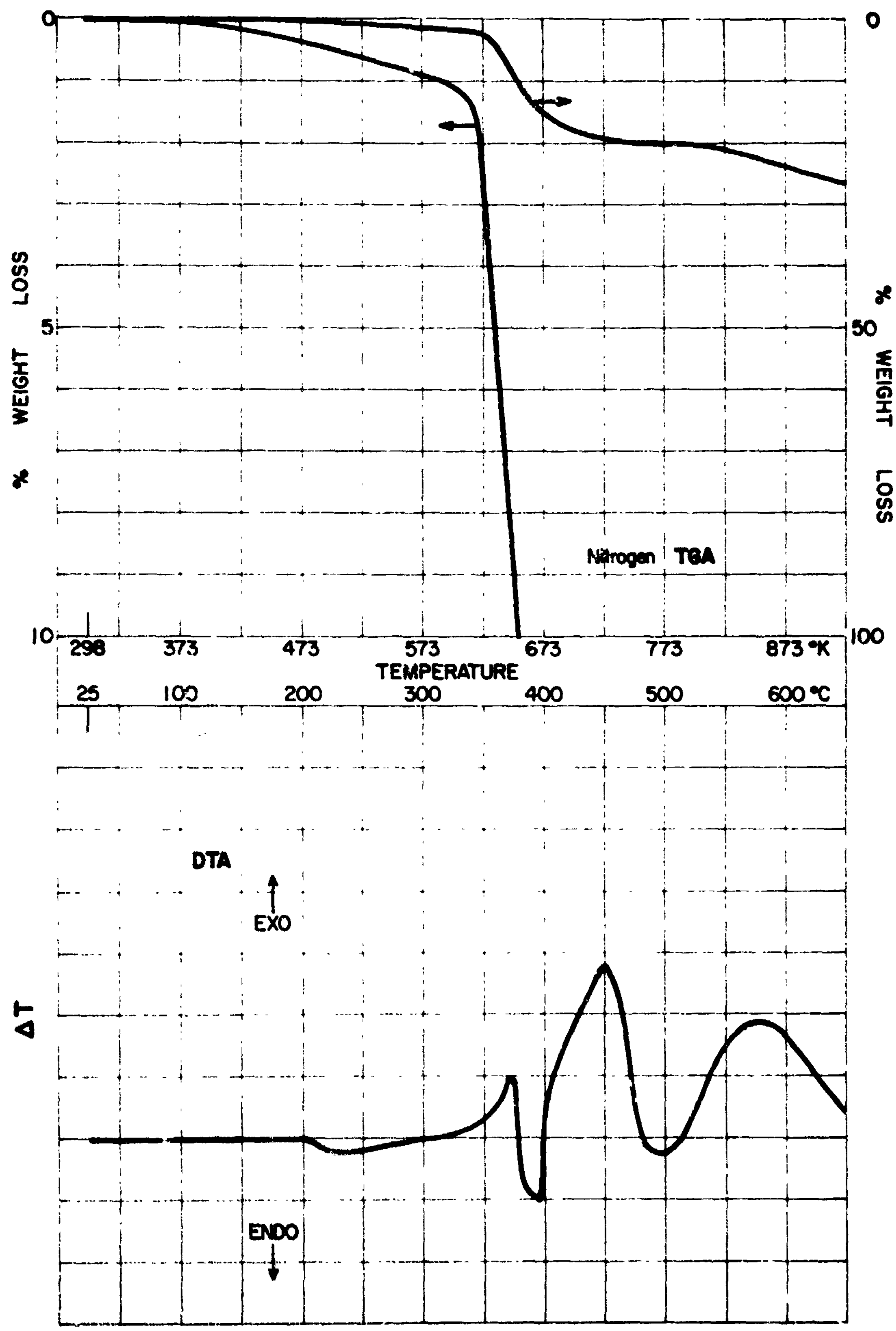
Time to 1% Weight loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	5×10^{38}	2×10^{46}
100°C (373°K)	2×10^{28}	8×10^{33}
150°C (423°K)	3×10^{20}	3×10^{24}



0
5
10
% WEIGHT LOSS
0
50
100
% WEIGHT LOSS
Vacuum TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
ΔP
Furnace Pressure

Stycast 2850 FT/Cat.11



E80

MASS NUMBER AND RELATIVE PEAK INTENSITY
TEMPERATURE, °C

m/e	25	200	361	400	500		
14	625	638	1603	930	848		
15	109	198	2953	765	480		
16	2600	2567	4524	3003	2927		
17	10870	9524	5016	9581	8943		
18	35259	29918	49277	29567	26561		
19							
20	52	58	93	69	60		
21							
22							
23							
24			108				
25			740	177	49		
26	63	170	3869	1152	286		
27	176	357	3579	1237	485		
28	9916	9208	16212	10832	9629		
29	54	89	4869	841	233		
30	653	678	1190	904	840		
31			1478	135			
32	2528	2404	2516	2270	2380		
33			57				
34							
35							
35			58				
37			685	168			
38			1563	430	54		
39		50	4985	1757	195		
40	858	889	2941	1569	1050		
41		92	1913	405	110		
42		130	1310	286	67		
43		56	2395	478	107		
44	244	461	3004	617	360		
45			174	47			
46			46				
47			246	46			
48			43				
49			207	52			
50			1198	390	55		
51			870	457	52		
52			235	111			
53			454	212			
54			86				
55			982	276			
56			707	67			
57			428	57			
58			197				
59							
60							
61			155	44			
62			278	93			
63			710	258			
64			155	68			
65			2058	730	60		
66			2768	738	46		
67			113	53			
68			82				
69							
70							
71							
72							
73			46				
74			91	45			
75			42				
76			40				
77			137	283	46		
78			102	49			
79			80	111			
80			47				
81							
82							
93							
84							
85							
86							
87							
88							
89			59	45			
90			50				
91			51	138			
92							

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	200	361	400	500		
93			50				
94			3748	747			
95			137				
96							
97							
98							
99							
100							
101							
102							
103							
104							
105							
106							
107				46			
108							
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Table 1. Dielectric Constant* (ASTM D150-68)
A 1 MHz

Exposure	Average	High	Low	Samples Tested
Baseline	5.59	5.73	5.50	3
Heat Compatibility (1)	5.63	5.65	5.62	3
Thermal Vacuum (2)	5.55	5.71	5.40	3

*Cured 4 hr at 165°F (347°K) followed by 4 hr at 270°F (405°K)

(1) 422 hr at 275°F (408°K) in N_2 atmosphere

(2) $1x10^{-6}$ Torr preceded by heat compatibility

Trucast 111M/901

Chemical Characterization Summary

Mix ratio: 100 pbw resin to 3.4 pbw catalyst
Cure: 3 hr at 150°F(338°K) plus 24 hr at 285° (414°K) and 1×10^{-5} Torr

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

   TGA Vacuum: None (Room Ambient)
   Nitrogen:

4. Activation Energy of Decomposition:

   In Vacuum:

   Over the range: 190°C-470°C (463°K-743°K)

   a_o = 30% of initial weight

   $$k = 1.6 \times 10^{15} \exp\left(\frac{-45600}{1.98\ T^{\circ}K}\right) \text{ min}^{-1}$$

   In Nitrogen:

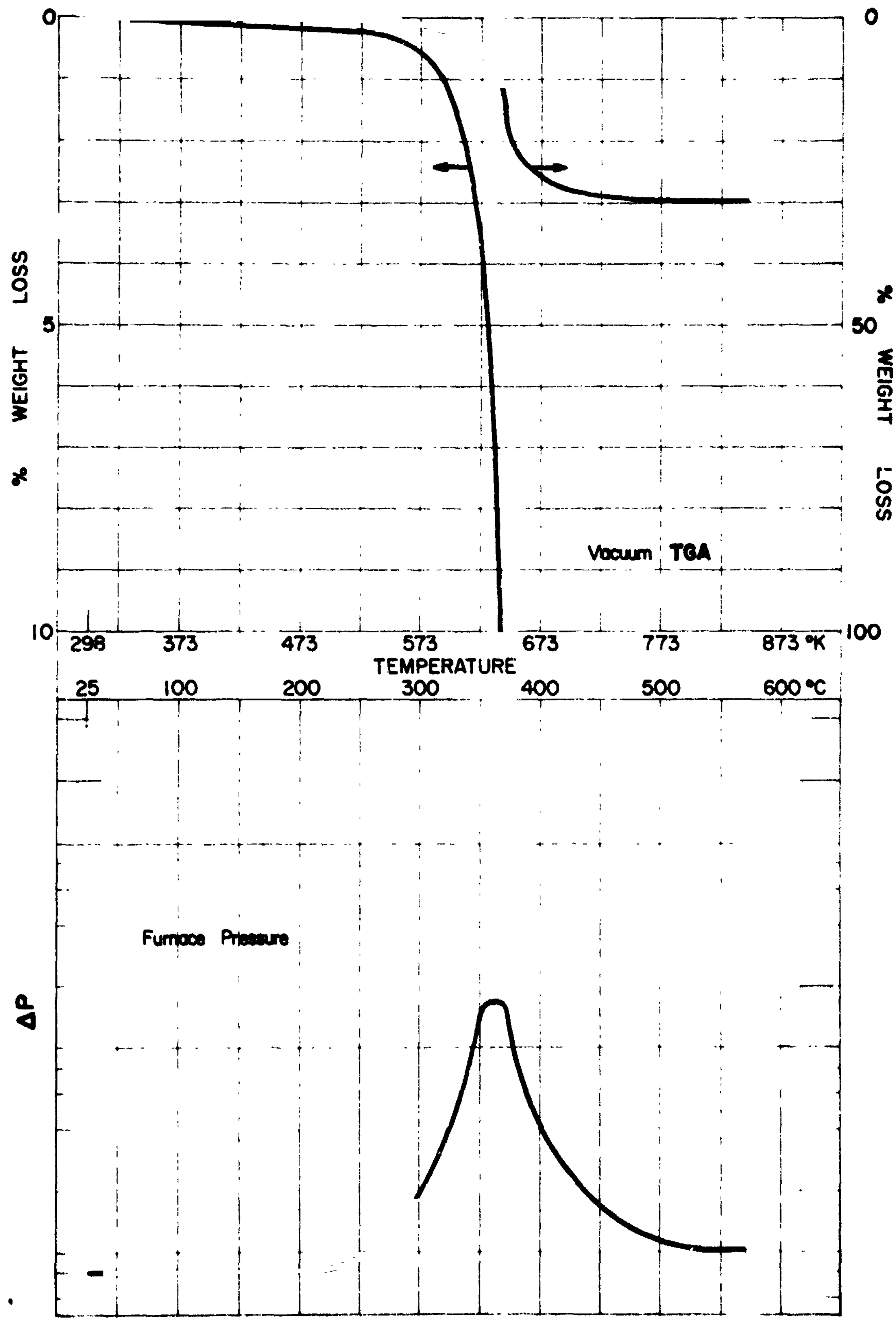
   Over the range:

   a_o = of initial weight

   $$k = \quad \exp\left(\frac{-}{1.98\ T^{\circ}K}\right) \text{ min}^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	3.7×10^{15}	
100°C (373°K)	2.6×10^{11}	
150°C (423°K)	1.6×10^{8}	


0
5
10
% WEIGHT LOSS
0
50
100
% WEIGHT LOSS
Vacuum TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
Furnace Pressure
ΔP

Trucast 111M/901

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	200	300	375	450		
14	742	679	943	2417	961		
15			323	4655	287		
16	1184	1082	1318	3498	1315		
17	5249	5959	6443	10490	5569		
18	24777	22968	24518	37721	20755		
19				43			
20							
21							
22							
23							
24				176			
25							
26	80	77	838	7814	616		
27		49					
28	12591	14970	17115	28805	15848		
29		46	1152	7412	548		
30			47	2906	66		
31				3067			
32	3636	3504	3313	3472	3240		
33				58			
34							
35							
36				40			
37							
38					43		
39			253	8721	704		
40	116	80	181		330		
41			814	5880	299		
42			199	5981	124		
43				5576	242		
44	250	278	1041	4236	378		
45				929			
46							
47				182			
48							
49							
50				1985	45		
51				2156	83		
52							
53				1425			
54							
55			41		44		
56			321	3148			
57			101	1857			
58				808			
59				70			
60				40			
61				141			
62							
63				1191			
64							
65					99		
66				4163	103		
67				636			
68				241			
69				56			
70				105			
71				112			
72				49			
73				61			
74				182			
75				56			
76				41			
77				1281	74		
78				318			
79				680			
80				428			
81				86			
82							
83							
84							
85							
86							
87							
88							
89			76				
90			92				
91			1182	45			
92			62				

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)
TEMPERATURE, °C

m/e	25	200	300	375	450		
93							
94			6947	190			
95			349	43			
96							
97							
98							
99							
100							
101							
102							
103			81				
104							
105			73				
106							
107			934	45			
108			47				
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119			822				
120			63				
121			669				
122			69				
123			47				
124							
125							
126							
127							
128							
129							
130							
131							
132							
133			57				
134			802				
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167			70				
168							
169							
170							
171							

Trucast 111M/902

Chemical Characterization Summary

Mix ratio: 100 pbw resin to 5 pbw hardener
Cure: 3 hr at 150°F (338°K) plus 24 hr at 285°F (413°K) and 10^{-5} Torr.

1. Isothermal Weight loss in Nitrogen·

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

   TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
   Nitrogen:

4. Activation Energy of Decomposition:

   In Vacuum:

   Over the range: 360°C-400°C (633°K-673°K)

   a_o = 30% of initial weight

   $$k = 3.4\times10^{28} \exp\left(\frac{-87600}{1.98\ T^{o}K}\right) \quad \text{min}^{-1}$$

   In Nitrogen:

   Over the range:

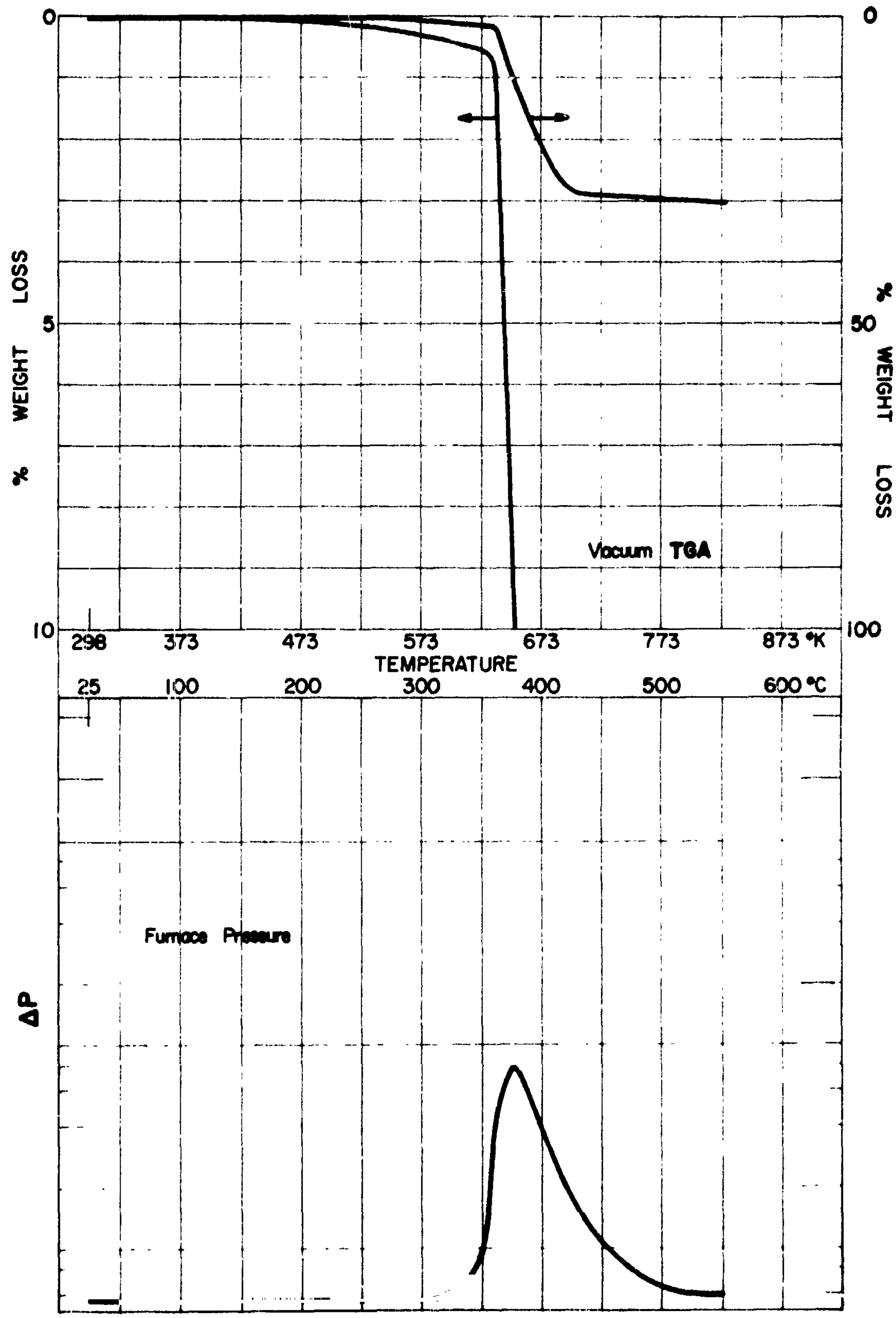
   a_o = of initial weight

   $$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \quad \text{min}^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	6×10^{30}	
100°C (373°K)	6.3×10^{22}	
150°C (423°K)	4.4×10^{16}	

Trucast 111M/902



Trucast 111M/902

MASS NUMBER AND RELATIVE PEAK INTENSITY
TEMPERATURE, °C

m/e	25	200	375	400	450	550	
14	3246	3097	8232	4977	3494	3961	
15	1223	1238	18158	7159	2809	3868	
16	11603	10497	;7338	12322	10258	12494	
17	34960	28309	43721	29166	23149	25603	
18	100986	82105	101070	84443	64704	71156	
19	178	167	1086	464	160	140	
20	580	471	600	519	443	520	
21							
22							
23							
24			683	280	77	74	
25	53		2712	1229	385	305	
26	667	564	13572	6414	2192	2020	
27	1534	1504	29516	11581	3705	3498	
28	39390	35034	60032	42424	35700	38553	
29	618	602	43601	12376	2295	1707	
30	3172	2861	5599	4005	2796	3166	
31		77	18711	3959	386	328	
32	11293	9877	8684	8100	8191	9358	
33			1209	188			
34			40				
35							
36			554	248	48		
37			1766	2244	541	148	
38			8826	4476	1038	360	
39	153	179	31772	14587	3759	1413	
40	5957	5340	14310	9105	5737	5838	
41	146	213	33678	8187	1511	1034	
42	97	89	11899	3391	747	447	
43	136	242	24902	5714	1274	738	
44	2944	2767	16627	5240	2796	2953	
45			5192	1313	144	100	
46			433	136			
47			1498	535	86		
48			169	69			
49			1460	726	135	54	
50			6697	3806	992	389	
51			5101	4610	1355	467	
52			1357	1464	483	172	
53			3592	2392	715	188	
54			1021	498	92	59	
55			9115	3198	684	265	
56			15591	2886	304	308	
57			19770	4041	217	119	
58			4048	734	87	46	
59			692	160			
60			563	255			
61			1859	876	173		
62			2935	1596	384	82	
63			5440	3280	933	253	
64			1795	1017	283	70	
65			13818	6844	1622	408	
66			18084	7204	1632	358	
67			1494	710	171	48	
68			746	320	57		
69			385	102			
70			251	40			
71			665	95			
72			829	178			
73			2027	470			
74			1818	872	177	41	
75			775	515	120		
76			606	381	92		
77			3565	3946	1304	373	
78			1315	1320	448	170	
79			1883	1768	628	140	
80			420	358	101		
81			204	162			
82			88	45			
83			43				
84	41		124	63	42		
85			103				
86			142	83			
87			2708	447			
88			142				
89			657	603	170		
90			570	498	119		
91			1204	2378	827	380	
92			342	360	98	65	

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont;

TEMPERATURE, °C

m/e	25	200	375	400	450	550	
93			1046	586	158	81	
94			24147	8608	1715	298	
95			1624	592	100		
96			83				
97							
98							
99							
100							
101							
102			47	110			
103			263	455	146		
104			137	150			
105			224	400	99	68	
106			263	241	42	78	
107			1385	2070	754	195	
108			635	974	328	57	
109			51	48			
110							
111							
112							
113							
114							
115			130	206	87		
116				51			
117			46	93			
118			412	178			
119			359	925	189		
120			317	401	55		
121			989	1509	508	63	
122			129	262	90		
123							
124							
125							
126							
127							
128							
129	45	45	77	49	54	56	
130							
131			108	140	63		
132	42		64	72	45	46	
133			57	147			
134			273	673	85		
135			44	135	48		
136			212	202	42		
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: As received film
Cure: 1 hr at 340°F (444°K) under vacuum of 20" Hg

1. Isothermal Weight loss in Nitrogen: 0.38%

2. Steady-State Vacuum Condensible Degassing Rate: 0.3×10^{-4} %/day

3. TGA Conditioning:

TGA Vacuum: 100 hr at 125°C (398°K) in N_2 atmosphere
Nitrogen: 24 hr at 23°C (296°K) and 45% RH

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 170°C-380°C (443°K-653°K)

a_o = 15.8% of initial weight

$$k = 1\times10^{2} \quad \exp\left(\frac{-10900}{1.98\ T^{o}K}\right) \quad \min^{-1}$$

In Nitrogen:

Over the range: 25°C-400°C (298°K-673°K)

a_o = 8.7% of initial weight

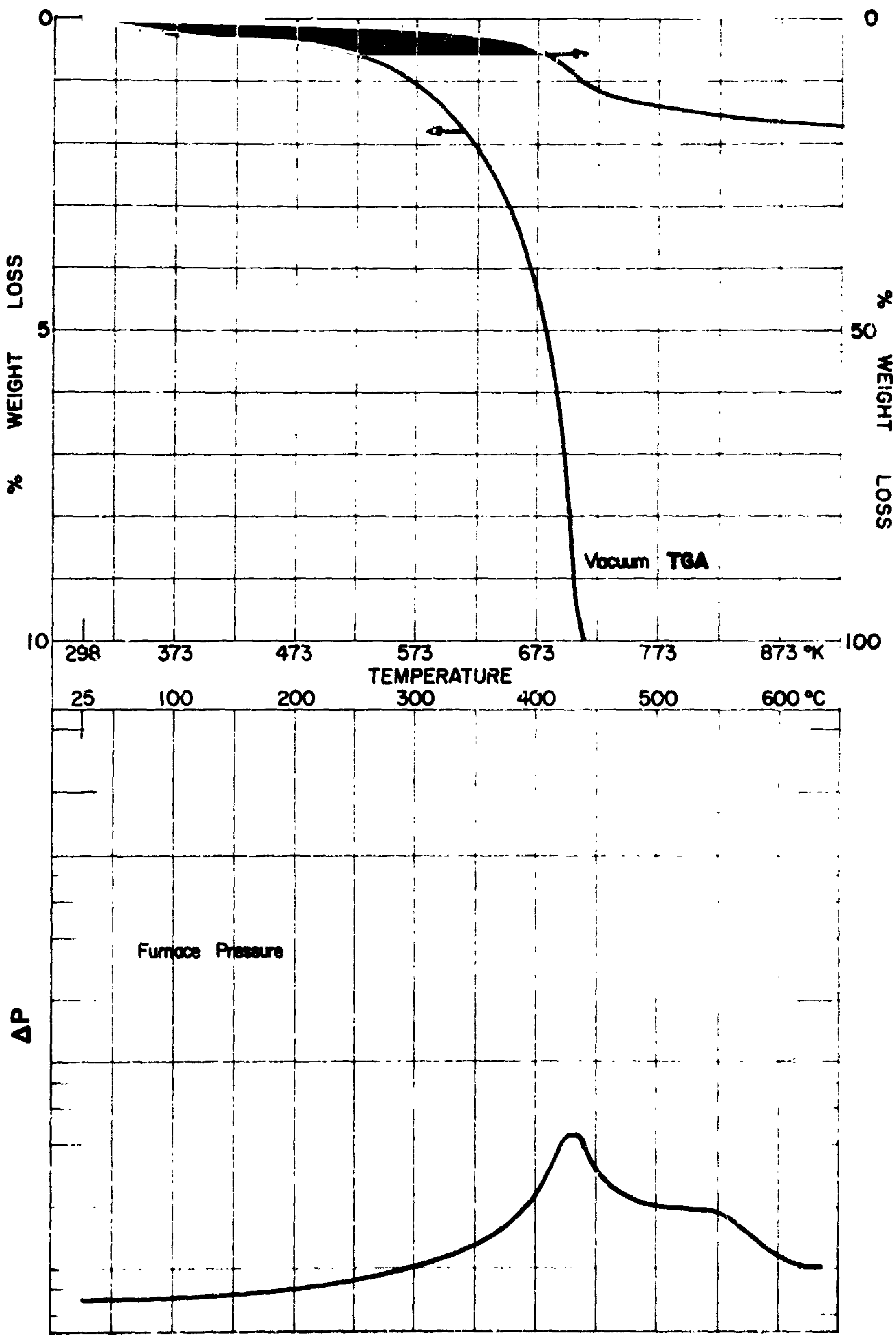
$$k = 9.3\times10^{3} \quad \exp\left(\frac{-14900}{1.98\ T^{o}K}\right) \quad \min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	1.6×10^{5}	8.4×10^{5}
100°C (373°K)	1.6×10^{4}	3.8×10^{4}
150°C (423°K)	2.7×10^{3}	3.4×10^{3}

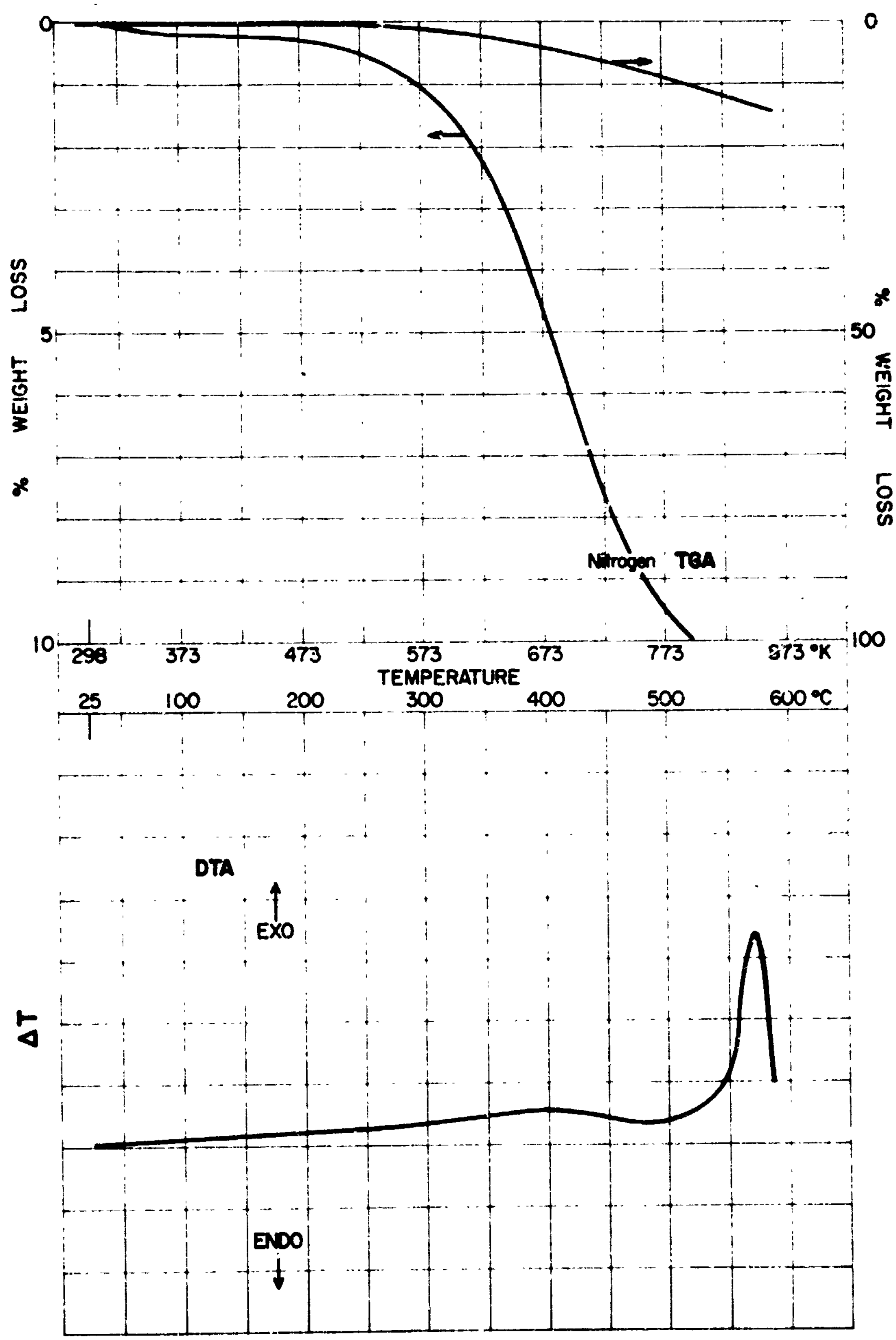
PRECEDING PAGE BLANK NOT FILMED

HT424 Adhesive Film



Ep2

HT424 Adhesive Film



HT424 Adhesive Film

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	100	250	425	475	600	
14	120	155	161	297	202	283	
15	43	47	104	566	209	1094	
16	1083	957	1718	1698	1366	2457	
17	7535	6255	6141	5504	4553	4121	
18	28094	22617	18321	18324	15290	13899	
19							
20	40	42		42			
21							
22							
23							
24							
25				[illegible]	43		
26			43	1209	296	146	
27			53	1239	477	181	
28	4320	4247	4352	7509	5660	5677	
29			46	594	108	60	
30	44	44	48	140	89	63	
31							
32	975	849	767	755	683	672	
33							
34							
35							
36							
37				160			
38				409	107	41	
39				2193	592	196	
40	252	257	275	1145	498	398	
41				148			
42				107			
43			56	531	81		
44	53	63	401	552	148	110	
45							
46							
47				41			
48							
49				43			
50				517	142	[illegible]	
51				631	[illegible]	60	
52				173	56		
53				334	118		
54							
55				211	47		
56							
57							
58							
59							
60							
61							
62				[illegible]			
63				265	75		
64				42			
65				[illegible]	[illegible]	68	
66				750	116		
67							
68							
69							
70							
71							
72							
73							
74							
75							
76							
77				494	150		
78				65			
79				201	67		
80							
81							
82							
83							
84							
85							
86							
87							
88							
89							
90							
91				63		43	
92							

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	100	250	425	475	600	
93							
94				547	72		
95							
96							
97							
98							
99							
100							
101							
102							
103							
104							
105							
106							
107				77			
108							
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

HT424 Adhesive Film

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	125	200	275	350	525	
172							
173							
174							
175							
176							
177							
178							
179							
180							
181							
182							
183					46		
184					140		
185				5932			
186				8639	304		
187							
188			54	11493			
189							
190			304				
191							
192							
193							
194							
195							
196							
197							
198							
199							
200							
201							
202							
203							
204							
205							
206							
207							
208							
209							
210							
211							
212							
213							
214							
215							
216							
217							
218							
219							
220							
221							
222							
223							
224							
225							
226							
227							
228							
229							
230							
231							
232							
233							
234							
235							
236							
237							
238							
239							
240							
241							
242							
243							
244							
245							
246							
247							
248							
249							
250							

Table 1 Lap Shear Test* (ASTM D1002)

Exposure	Average		High		Low		Samples Tested
	psi	Pa $\times 10^{-7}$	psi	Pa $\times 10^{-7}$	psi	Pa $\times 10^{-7}$	
Baseline	3160	2.18	3290	2.27	3070	2.12	10
Tested at 75°F(297°K) after Heat Compatibility (1)	3170	2.19	3230	2.23	3120	2.15	5
Tested at -100°F(200°K) after Heat Compatibility (1)	3260	2.25	3340	2.30	3160	2.18	5
Tested at +300°F(422°K) after Heat Compatibility (1)	2210	1.52	2310	1.59	2080	1.43	5
Tested at +400°F(477°K) after Heat Compatibility (1)	1750	1.21	1890	1.30	1590	1.10	5
Tested at +500°F(533°K) after Heat Compatibility (1)(2)	1320	0.91	1380	0.95	1290	0.89	5

*Cure: 1 hour at 340°F(444°K) under vacuum of 20" Hg

(1) Heat Compatibility - 380 hours @ 275°F (408°K)

(2) Thermal Vacuum - 33 days @ 150°F(338°K) at 1×10^{-6} Torr

Chemical Characterization Summary

Mix ratio: As received
Cure: As received

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: None (Room Ambient)
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 350°C-380°C (623°K-653°KO

a_o = 100% of initial weight

$$k = 1.8\text{x}10^{16} \ \exp\left(\frac{-53900}{1.98\ T^{o}K}\right) \ \text{min}^{-1}$$

In Nitrogen:

Over the range:

a_o = of initial weight

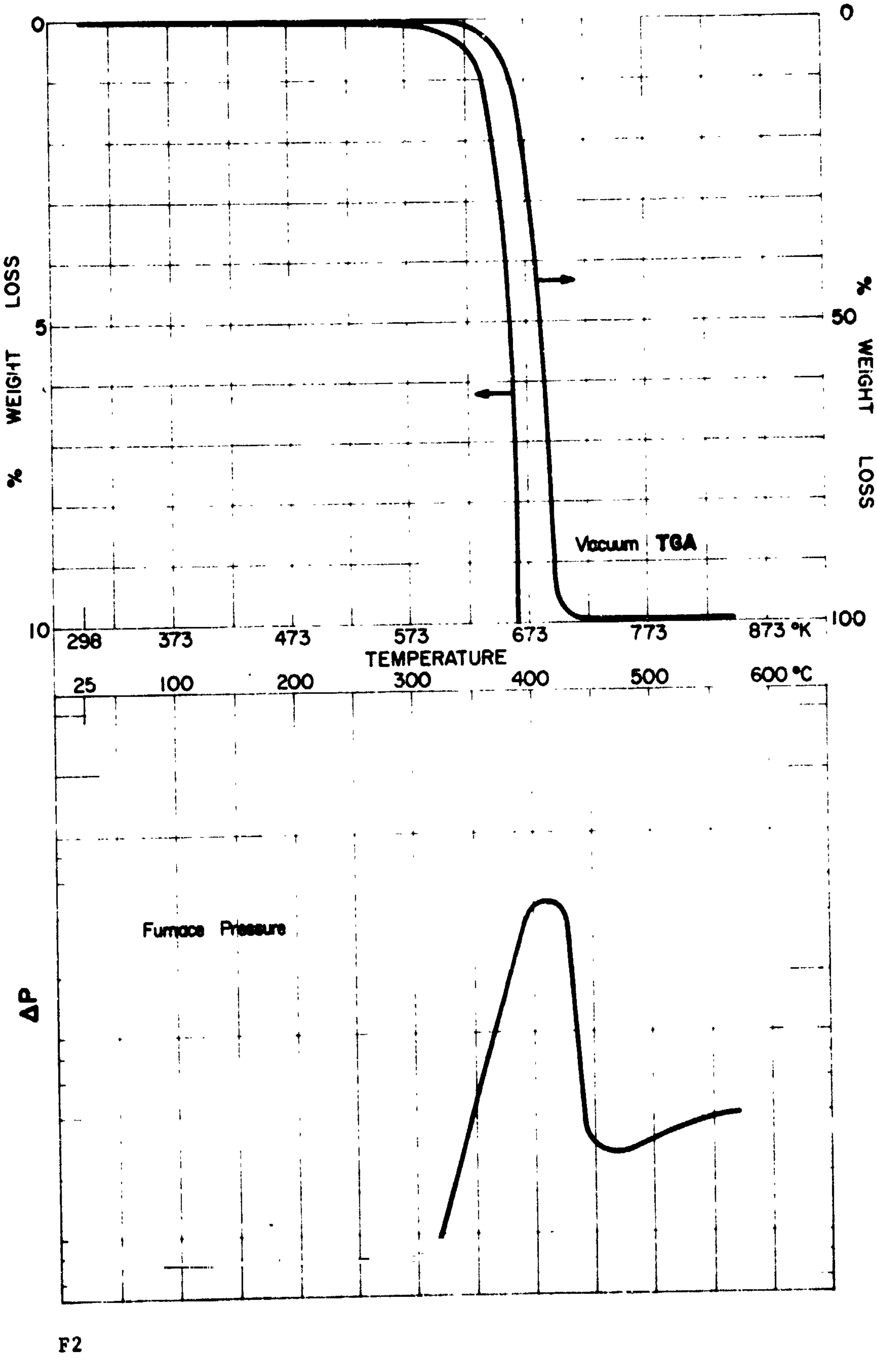
$$k = \ \exp\left(\frac{-}{1.98\ T^{o}K}\right) \ \text{min}^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	$1.4\text{x}10^{20}$	
100°C (373°K)	$1.7\text{x}10^{15}$	
150°C (423°K)	$2.9\text{x}10^{11}$	

PRECEDING PAGE BLANK NOT FILMED

Aclar Film



F2

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	200	325	400	525		
14	1590	1488	1496	2257	1420		
15	299	291	296	1306	390		
16	2612	2361	2316	4204	2344		
17	11190	8637	7479	7904	6556		
18	41415	31017	26651	26662	22950		
19	677	800	924	6962	4360		
20	114	130	131	3199	1666		
21							
22							
23							
24				9955	564		
25				231			
26	69	77	125	682	123		
27							
28	26000	24260	24819	51105	25827		
29	190	204	260	922	378		
30	85	78					
31				100770	23370		
32	6141	5557	5212	8077	4996		
33				103			
34							
35			41	19603			
36					3224		
37				6352	509		
38				1233	815		
39							
40	1537	1417	1562	8979	1825		
41				92	49		
42				89			
43			102	12077			
44	557	553	808	3083	1716		
45				258	52		
46							
47			403	64967	4873		
48							
49			81'				
50			154	38067	3619		
51				890	101		
52							
53							
54							
55				925	55		
56				85			
57							
58				3348	94		
59					84		
60				62			
61					45		
62			62	12095	1058		
63				335			
64							
65							
66			922	86048	6963		
67							
68			128	28658			
69			54	24203	3779		
70				93			
71							
72							
73							
74				1857	171		
75				691	65		
76							
77							
78				3630	344		
79							
80					58		
81			226	41378	3601		
82					65		
83							
84							
85			551	77457	7420		
86							
87			58	23016	1861		
88				71			
89							
90				67			
91				57			
92							

Aclar Film

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, ^{o}C

m/e	25	200	325	400	525		
93				6526	1311		
94				317			
95				200			
96							
97			206	43911	3467		
98					53		
99				13736	966		
100					133		
101				5975	356		
102				137			
103				3592	161		
104							
105				591	48		
106							
107							
108							
109				878	87		
110							
111				142			
112				864	63		
113				622			
114							
115							
116				100790	11424		
117			1414				
118				5948	354		
119			221	43228	3470		
120				891			
121							
122							
123							
124					59		
125				240			
126				49			
127							
128							
129		46	46	1321	126		
130							
131			101	2369	188		
132		48		28132	4115		
133	40	55	85	2378			
134							
135				463			
136				234			
137				282			
138				86			
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: As received film.
Cure: As received

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: 24 hrs at 23°C (296°K) and 45% RH.
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum: Not amenable to analysis

Over the range:

a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \quad min^{-1}$$

In Nitrogen:

Over the range:

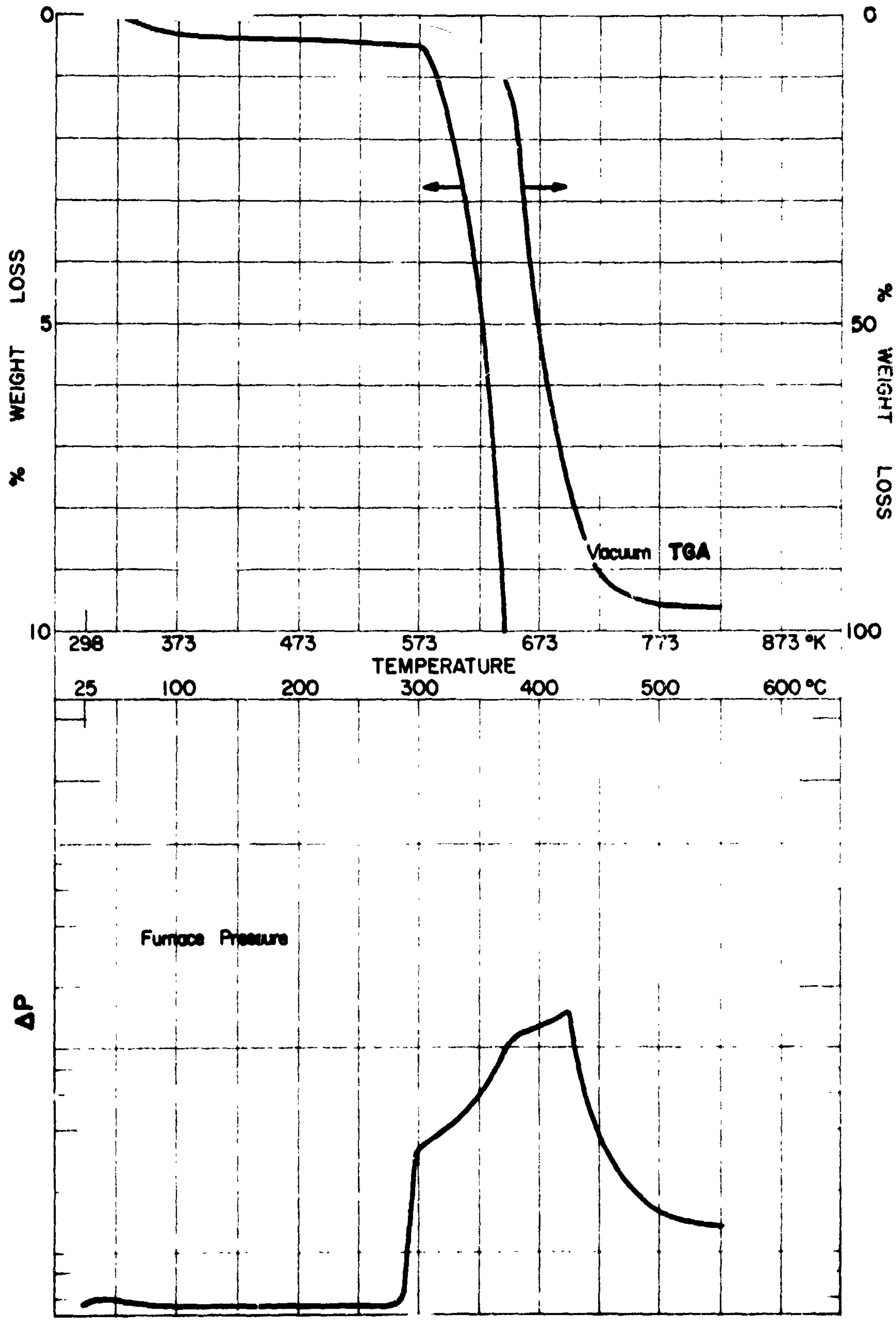
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \quad min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)		
100°C (373°K)		
150°C (423°K)		

Tedlar



0
5
10
% WEIGHT LOSS
0
50
100
% WEIGHT LOSS
Vacuum TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
Furnace Pressure
ΔP

F6

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	300	361	425	500		
14	1204	1608	1209	1710	1168		
15	331	606	883	2020	1189		
16	2738	3193	2968	4574	3372		
17	9789	11121	11404	12855	7929		
18	39345	36311	48290	52154	30364		
19	277	892	5134	[illegible]	2567		
20	261	4669	49055	[illegible]	6077		
21							
22							
23							
24		77	233	401	72		
25	73	478	710	1526	474		
26	518	2389	3932	7668	1801		
27	805	1982	3404	12275	2588		
28	30876	37102	33320	44123	35136		
29	493	1179	1319	5618	1455		
30	641	686	991	1503	981		
31	88	224	430	966	168		
32	5377	6214	4473	5054	4797		
33			227	1452	59		
34				83			
35			87	99			
36		154	474	651	110		
37	41	750	1945	1860	193		
38	59	958	2812	3382	450		
39	150	2409	6560	14947	1611		
40	3397	4008	4756	6927	4113		
41	194	284	812	8265	1125		
42	94	212	491	2702	505		
43	384	617	932	2834	705		
44	835	1179	1275	2051	960		
45	59	221	542	1175	177		
46		59	323	1565	66		
47		77	725	3129	97		
48		48	202	217			
49		456	1186	1001	58		
50		2738	7273	5376	575		
51		2770	7294	7371	623		
52		2449	5509	3280	304		
53		122	567	2159	161		
54			124	1042	69		
55		62	225	2630	182		
56		54	129	889	126		
57		41	171	991	81		
58			80	307			
59			268	2175	67		
60		52	268	894			
61		78	[illegible]	928			
62		103	[illegible]	956	42		
63		486	[illegible]	2308	[illegible]		
64		57	336	792	54		
65		55	336	2016	113		
66		43	181	692	82		
67			111	1383			
68			63	534			
69			45	416			
70			80	349			
71			43	237			
72			46	595			
73		65	345	700			
74		239	739	861			
75		73	369	552			
76		206	556	609			
77		792	2295	2347	155		
78		3763	8265	3875	201		
79		222	590	1356	75		
80			75	307			
81			51	351			
82				118			
83			51	169			
84				58			
85			122	496	59		
86			40	176			
87			42	180			
88				97			
89			49	286			
90				124			
91			247	1708	91		
92			37	542			

Tedlar

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	300	361	425	500		
93				124			
94			45	58			
95				62			
96			74	143			
97				74			
98				57			
99				68			
100				43			
101							
102			72	81			
103			44	148			
104				99			
105				221			
106				82			
107							
108							
109							
110							
111							
112							
113							
114							
115				42			
116				106			
117				40			
118				71			
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129			55				
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146			41				
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170			46				
171							

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

	TEMPERATURE, °C						
m/e	25	300	361	425	500		
172							
173							
174							
175							
176							
177							
178							
179							
180							
181							
182							
183							
184							
185							
186							
187			40				
188			45				
189							
190			44				
191							
192							
193							
194							
195			41				
196							
197							
198							
199							
200			54				
201							
202							
203							
204							
205			44				
206							
207			44				
208			42				
209							
210			45				
211							
212			41				
213			42				
214							
215							
216							
217			44				
218			56				
219			48				
220							
221							
222							
223			40				
224							
225			45				
226							
227			46				
228							
229							
230			43				
231			41				
232							
233			42				
234							
235							
236							
237			41				
238							
239			41				
240			41				
241							
242			49				
243			48				
244			42				
245							
246							
247							
248							
249							
250							

Viton A-Parker Compound V747-75

Chemical Characterization Summary

Mix ratio: As Received
Cure: As Received

1. Isothermal Weight loss in Nitrogen: 0.08%

2. Steady-State Vacuum Condensible Degassing Rate: 4.60×10^{-6} %/day

3. TGA Conditioning:

TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 300°C-550°C (573°K-823°K)

a_o = 66% of initial weight

$$k = 2.3 \times 10^{17} \exp\left(\frac{-60300}{1.98\ T^{\circ}K}\right) \min^{-1}$$

In Nitrogen:

Over the range:

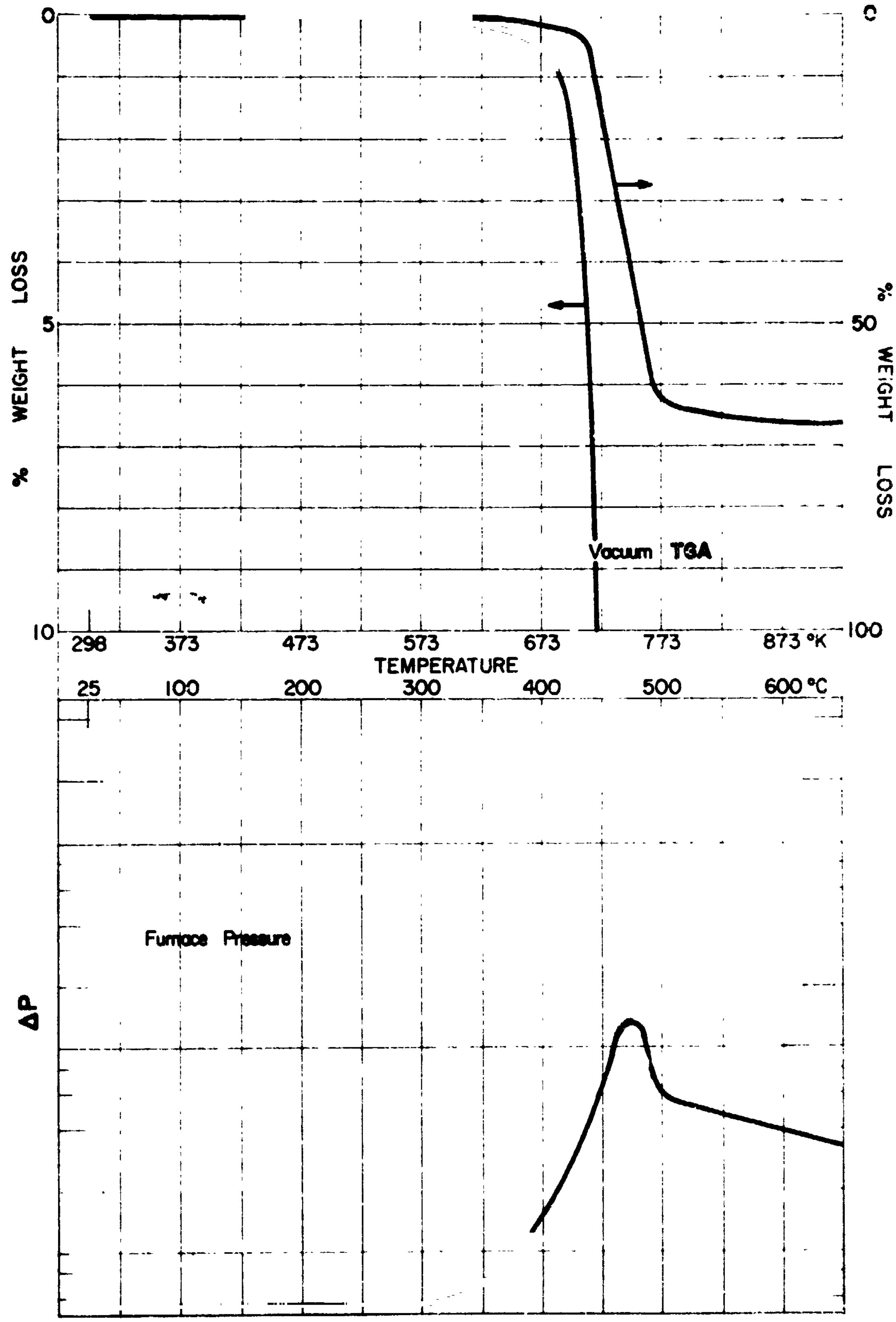
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{\circ}K}\right) \min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	2.9×10^{23}	
100°C (373°K)	8.0×10^{17}	
150°C (423°K)	4.6×10^{13}	

Viton A-Parker Compound V747-75



Viton A Parker Compound V747-75

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	250	400	475	550		
14	652	591	605	1111	864		
15			78	218	122		
16	1458	1123	2803	1942	1247		
17	11130	7716	11932	9918	7605		
18	45093	31826	47426	40160	29585		
19		92	146	2011	1065		
20			987	20764	10272		
21							
22							
23							
24				124			
25			40	412	48		
26	62	83	558	1472	333		
27	220	179	684	2294	571		
28	24445	21106	27078	30772	29332		
29	250	199	560	989	439		
30	75	108	149	327	260		
31	76	74	1636	11806	3500		
32	6320	5578	5592	6334	5541		
33			138	2666	669		
34							
35							
36				140	75		
37				658	72		
38			45	1050	126		
39			344	4138	718		
40	289	297	497	1284	466		
41	44	50	116	383	144		
42	46		106	189	107		
43	68	101	457	1177	419		
44	704	1055	16660	10056	5695		
45			879	6274	2184		
46			125	2125	186		
47				686	297		
48				93	1092		
49				85	4390		
50			408	4404			
51			4820	30046			
52				230			
53				60			
54							
55			79	521	81		
56			117	1504	192		
57			421	3878	686		
58				111			
59			78	1406	46		
60				676	81		
61				125			
62				517	90		
63			79	1830	310		
64			1359	11158	2776		
65			351	3939	466		
66				218	84		
67							
68				649	51		
69			4037	27383	5175		
70				479			
71				58			
72							
73							
74				619			
75			1457	10628	1943		
76				653	47		
77			1276	10354	1561		
78			59	190			
79				85			
80				88			
81			52	928	155		
82			68	1176	96		
83				662	45		
84				51			
85			44	1840	2850		
86				93	43		
87				259	43		
88				1051	62		
89			41	1411	68		
90				133			
91				139			
92							

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	250	400	475	550		
93			88	1588	105		
94			41	903	79		
95			991	6857	862		
96				237			
97							
98							
99				284			
100				432			
101			139	1977	129		
102				58			
103							
104							
105				40			
106				204			
107							
108				913	61		
109							
110							
111				195			
112							
113				95			
114			1450	11344	2143		
115				379			
116			57	1757			
117							
118							
119							
120				579			
121							
122				157			
123							
124							
125							
126				101			
127				83			
128				88			
129							
130							
131							
132				50			
133				87			
134				931			
135							
136							
137							
138				45			
139							
140				92			
141							
142							
143							
144							
145				44			
146				121			
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164				175			
165							
166							
167							
168							
169							
170							
171							

Viton A-Parker Compound V747-75

Table 1 Compression Set Values (FTMS 601 Method 3311)

Exposure	% of Original Deflection			Samples Tested
	Average	High	Low	
Heat Compatibility (1)	22.5	22.6	22.[illegible]	2
Heat Compatibility (1) plus 30 day thermal vacuum (2)	20.6	21.3	19.8	2
Heat compatibility (1) plus 90 day thermal vacuum (2)	22.4	22.4	22.3	2
Heat compatibility (1) plus 30 days room ambient	24.6	25.1	24.1	2
Heat compatibility (1) plus 90 days room ambient	24.1	24.7	23.5	2
46 days room ambient	15.0	15.0	14.9	2
106 days room ambient	15.1	15.1	15.0	2

(1) 380 hours at 275^{o}F (408^{o}K) in N_2 atmosphere

(2) Tested at $1x10^{-5}$ Torr after the specified exposure time at 150^{o}F (338^{o}K) and $1x10^{-6}$ Torr

Chemical Characterization Summary

Mix ratio: As received sheet stock
Cure: As received

1. Isothermal Weight loss in Nitrogen: 0.20%

2. Steady-State Vacuum Condensible Degassing Rate: 1.53×10^{-4} %/day

3. TGA Conditioning:

TGA Vacuum: 100 hr at 125°C (398°K) in N_2 atmosphere
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 25°C-450°C (298°K-723°K)

a_o = 60% of initial weight

$$k = 3.3 \times 10^{10} \exp\left(\frac{-40400}{1.98\ T^{\circ}K}\right) \text{min}^{-1}$$

In Nitrogen:

Over the range:

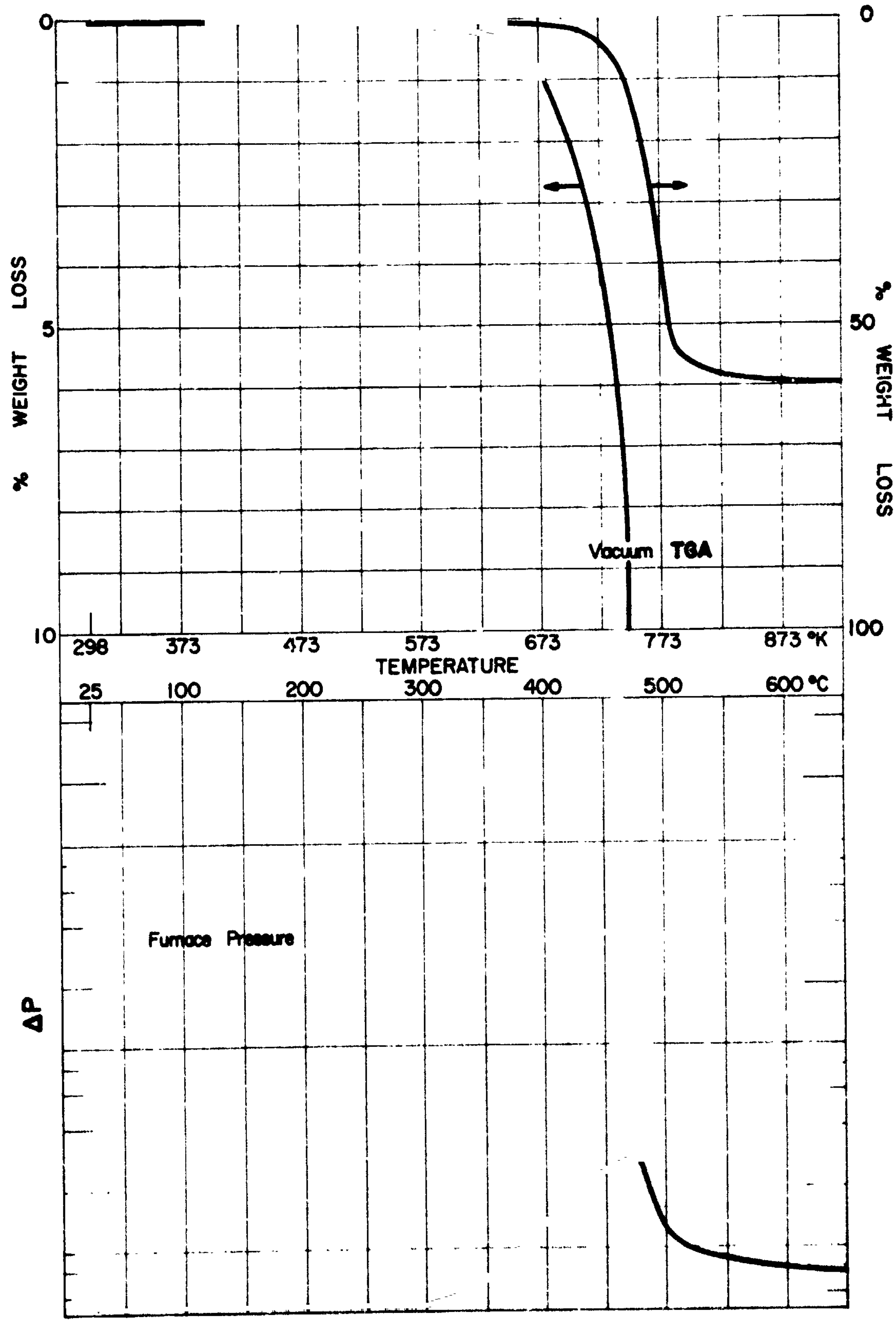
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{\circ}K}\right) \text{min}^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	5.2×10^{16}	
100°C (373°K)	1.1×10^{13}	
150°C (423°K)	1.6×10^{10}	

Viton A Parker Compound 77-545



F16

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	200	400	500	600		
14	597	604	666	996	649		
15	131	111	172	334	139		
16	2593	2457	2745	3201	2630		
17	11167	9300	9153	11803	8425		
18	37025	29532	28824	37889	25815		
19			228	4783	2858		
20	40		225	15629	2888		
21							
22							
23							
24				48			
25				142			
26			101	535	40		
27		94	273	810	168		
28	8944	8582	9901	14843	11712		
29	45		123	431	117		
30	341	364	436	717	470		
31			53	3687	213		
32	1829	1654	1630	1875	1491		
33				543			
34							
35							
36							
37				161			
38				225			
39				660			
40	765	795	890	1331	910		
41				61			
42			41	145			
43			170	806	110		
44	253	226	2707	4296	2417		
45			51	1327	63		
46				261			
47				289	178		
48			87	55			
49							
50				1011	48		
51			94	5528	186		
52				55			
53							
54							
55				85			
56				344			
57				790			
58							
59				113			
60				46			
61				48			
62				176			
63				364			
64			153	2001	58		
65				427			
66				120			
67							
68				138			
69			68	6818	273		
70				74			
71							
72							
73							
74				134			
75				2456	55		
76				139			
77				1261			
78				45			
79							
80							
81				263			
82				173			
83				59			
84							
85				157	594		
86				43			
87				44			
88				148			
89				79			
90							
91							
92							

Viton A Parker Compound 77-545

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	200	400	500	600		
93				286			
94				125			
95				876			
96							
97							
98							
99				61			
100				67			
101				153			
102							
103							
104							
105							
106				43			
107							
108				54			
109							
110							
111							
112							
113				565			
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Table 1 Compression Set (FTMS 601 Method 3311)

Exposure	% of Original Deflection			Samples Tested
	Average	High	Low	
Heat Compatibility (1)	43.1	44.8	40.0	3
Heat compatibility plus 30 day thermal vacuum (1)(2)	34.8	35.8	33.6	3

(1) 382 hours at 275°F (408°K) in N_2 atmosphere

(2) Tested at a pressure of $1x10^{-5}$ Torr after heat compatibility (2) followed by 30 day exposure at 150°F (338°K) and $1x10^{-6}$ Torr

Viton A, Mil-R-25897E Type 2 Class 1

Chemical Characterization Summary

Mix ratio: As received sheet stock
Cure: As received

1. Isothermal Weight loss in Nitrogen: 0.15%

2. Steady-State Vacuum Condensible Degassing Rate: 1.128×10^{-4} %/day

3. TGA Conditioning:

TGA Vacuum: 100 hr at 125°C (398°K) in N_2 atmosphere
Nitrogen: 24 hr at 23°C (296°K) and 45% RH

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 25°C-440°C (298°K-713°K)

a_o = 63% of initial weight

$$k = 3.4 \times 10^4 \exp\left(\frac{-21600}{1.98\ T^{\circ}K}\right) \ \text{min}^{-1}$$

In Nitrogen:

Over the range: 25°C-440°C (298°K-713°K)

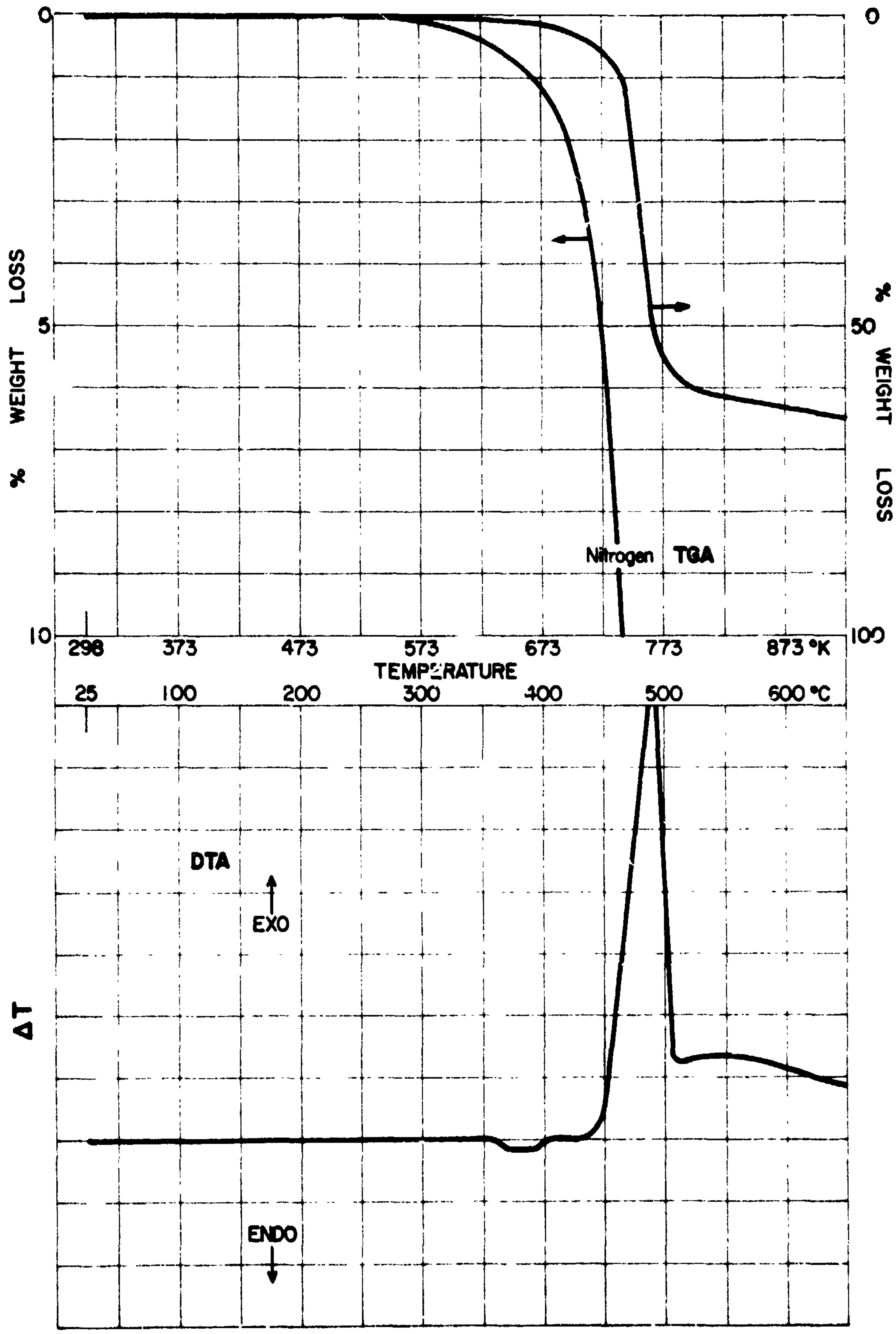
a_o = 62% of initial weight

$$k = 5.4 \times 10^4 \exp\left(\frac{-21600}{1.98\ T^{\circ}K}\right) \ \text{min}^{-1}$$

Time to 1% Weight Loss at Temperature T

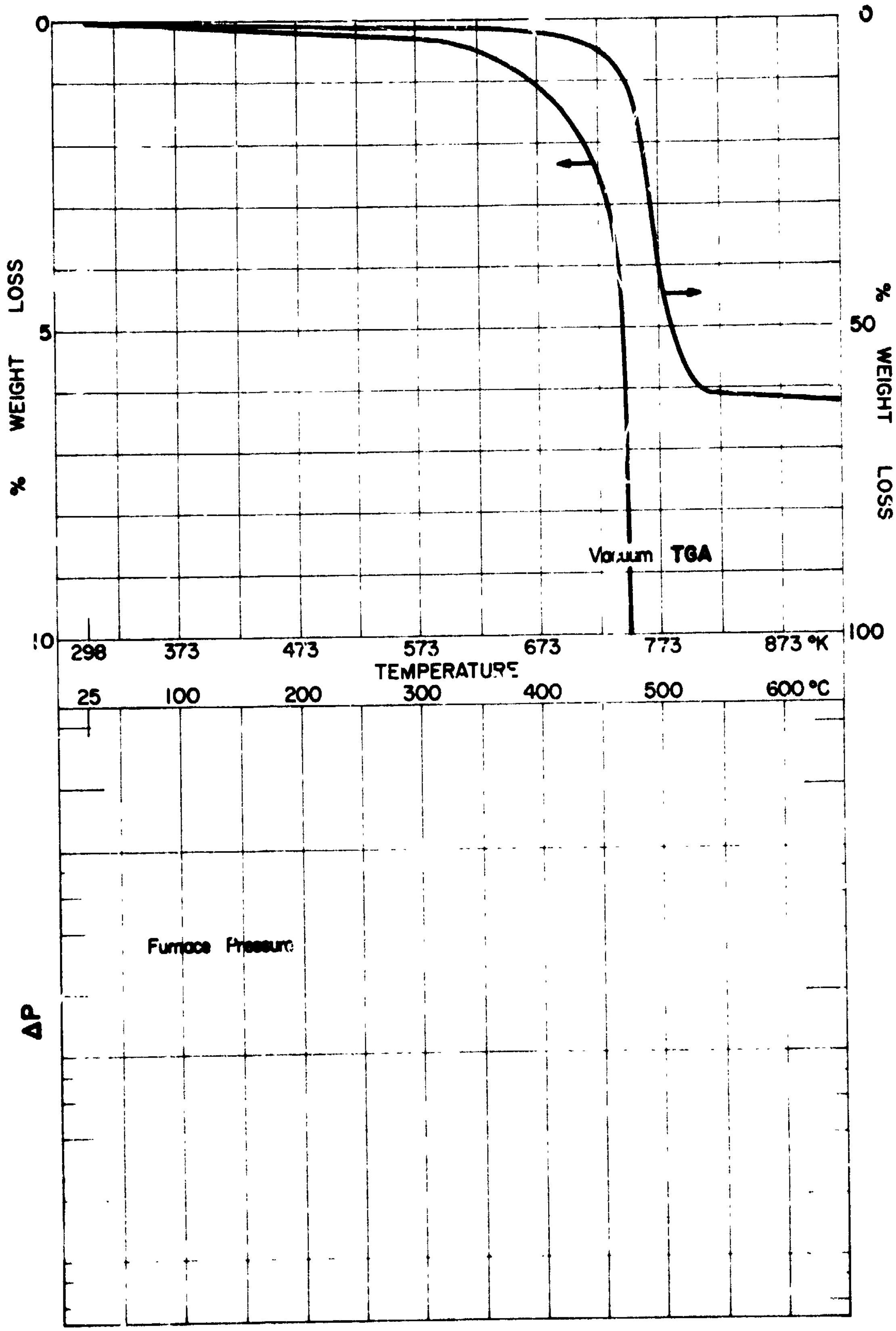
Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	8.4×10^9	5.3×10^9
100°C (373°K)	9.1×10^7	5.7×10^7
150°C (423°K)	2.8×10^6	1.7×10^6

Viton A, Mil-R-25897E Type 2 Class 1



F21

Viton A, Mil-R-25897E Type ^ Class 1



MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	200	425	500	525	600	
14	279	334	318	587	381	370	
15	112	113	175	228	193	130	
16	1627	1761	2102	2431	2069	2072	
17	9969	8466	8728	9539	[illegible]	7510	
18	34710	28468	29805	32046	[illegible]	24490	
19			88	1273	537	345	
20	64	82	2138	17411	7133	4240	
21							
22							
23							
24				60			
25				129	40		
26	65	64	127	414	144	92	
27	94	98	142	547	190	182	
28	[illegible]	6282	8103	11494	9562	[illegible]	
29	79	81	156	255	184	133	
30	137	148	148	297	244	217	
31	72	81	26	3383	836	363	
32	1384	1284	1319	1550	1401	1297	
33				428	71	52	
34							
35							
36				41			
37				122			
38				162	41		
39			43	552	114	[illegible]	
40	998	1052	1205	[illegible]	1306	1236	
41			41	45	45	43	
42			42	62	50		
43	52	43	86	271	117	103	
44	118	135	2830	3251	1972	2110	
45			97	1291	242	133	
46			42	220	55	44	
47				100	69	46	
48			80	46			
49							
50			45	712	128	[illegible]	
51			123	5173	696	203	
52				[illegible]			
53							
54							
55				76			
56				[illegible]			
57				545	75		
58				[illegible]			
59				73			
60				45			
61							
62				84			
63				231	43		
64			119	1661	234	106	
65				351	52		
66				55			
67							
68				95			
69			102	[illegible]	721	196	
70				[illegible]			
71							
72							
73							
74				64			
75			43	1796	145	61	
76				64			
77				1074	129	40	
78							
79							
80							
81				91			
82				102			
83				46			
84							
85				338	245	133	
86							
87				46			
88				65			
89				66			
90							
91							
92							

Viton A Mil-T-25897E Type 2 Class 1

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	200	425	500	525	600	
93				96			
94				62			
95				439			
96							
97							
98							
99							
100							
101				58			
102							
103							
104							
105							
106							
107							
108							
109							
110							
111							
112							
113				129			
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: As received
Cure: As received

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 100°C-500°C (373°K-773°K)

a_o = 30% of initial weight

$$k = 2.4\times10^{17} \exp\left(\frac{-\ 57400}{1.98\ T^{o}K}\right) \ \text{min}^{-1}$$

In Nitrogen:

Over the range:

a_o = of initial weight

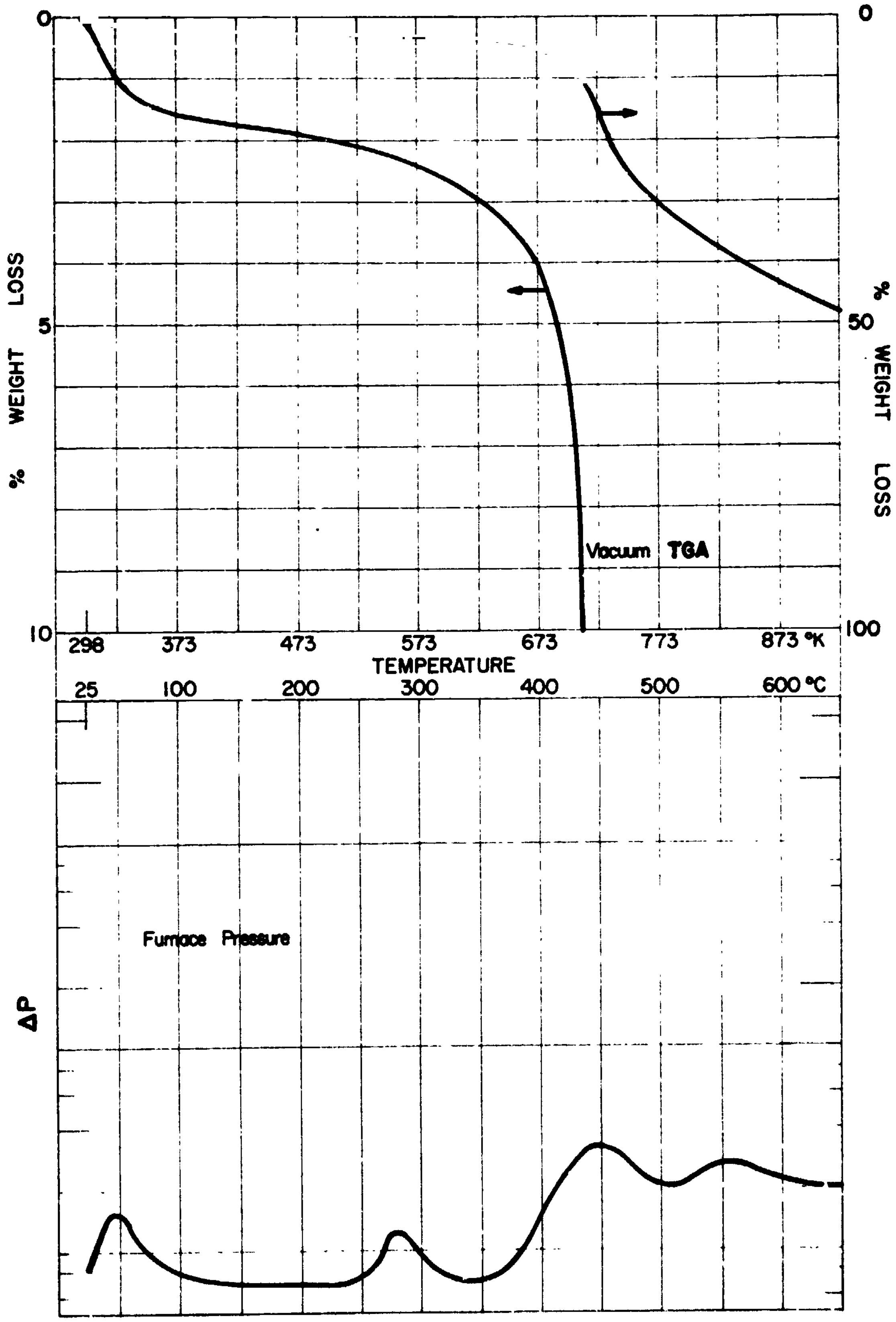
$$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \ \text{min}^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	2.6×10^{21}	
100°C (373°K)	1.5×10^{16}	
150°C (423°K)	1.4×10^{12}	

PRECEDING PAGE BLANK NOT FILMED

Nomex Thread Mil-T-43636



MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	100	350	450	550	650	
14	770	693	760	1187	1155	1776	
15	150	163	288	396	517	2352	
16	3566	3413	3139	8284	6782	9191	
17	14059	12401	10267	20042	15703	14998	
18	48263	42049	33502	68378	51006	35055	
19	47		45	77	55	52	
20	93	99	110	196	194	151	
21							
22				153	76		
23							
24				85	79	48	
25				365	270	141	
26	66	96	151	2720	2992	3884	
27	191	181	316	2886	4629	15548	
28	16382	16306	16251	32919	45361	24065	
29	562	577	581	746	880	606	
30	985	962	958	1412	1363	1198	
31			41	44	72	69	
32	4369	4091	3631	4076	3951	3977	
33							
34							
35							
36					77	41	
37				79	514	301	
38				94	796	378	
39				163	1854	1073	
40	1208	1185	1214	2151	2354	2142	
41			54	146	252	191	
42				141	129	123	
43			117	224	429	269	
44	475	515	914	39883	23387	1354	
45			45	296	227	121	
46				73	74	42	
47					52		
48				75	53	43	
49					297	145	
50				409	2903	1585	
51				268	2184	1138	
52				132	1047	793	
53					104	63	
54					58		
55							
56							
57							
58							
59							
60					44		
61					109	53	
62					117	80	
63					362	159	
64					131	85	
65					317	109	
66					408	126	
67					45		
68							
69							
70							
71							
72							
73					100	90	
74				42	183	138	
75					399	158	
76				71	1885	818	
77				85	661	383	
78				127	1523	1943	
79					70	72	
80							
81							
82							
83							
84							
85							
86							
87							
88							
89							
90							
91					175	60	
92					113		

Nomex Thread Mil-T-43636

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)
TEMPERATURE, °C

m/e	25	100	350	450	550	650	
93					334	126	
94							
95							
96							
97							
98							
99							
100							
101							
102							
103					755	191	
104							
105							
106							
107							
108							
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: As Received
Cure: As Received

1. Isothermal Weight loss in Nitrogen: 5.62%

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 110°C-200°C (383°K-473°K)

a_o = 2.6% of initial weight

$$k = 6.3x10^{12} \exp\left(\frac{-26000}{1.98\ T^oK}\right) \ \min^{-1}$$

In Nitrogen:

Over the range:

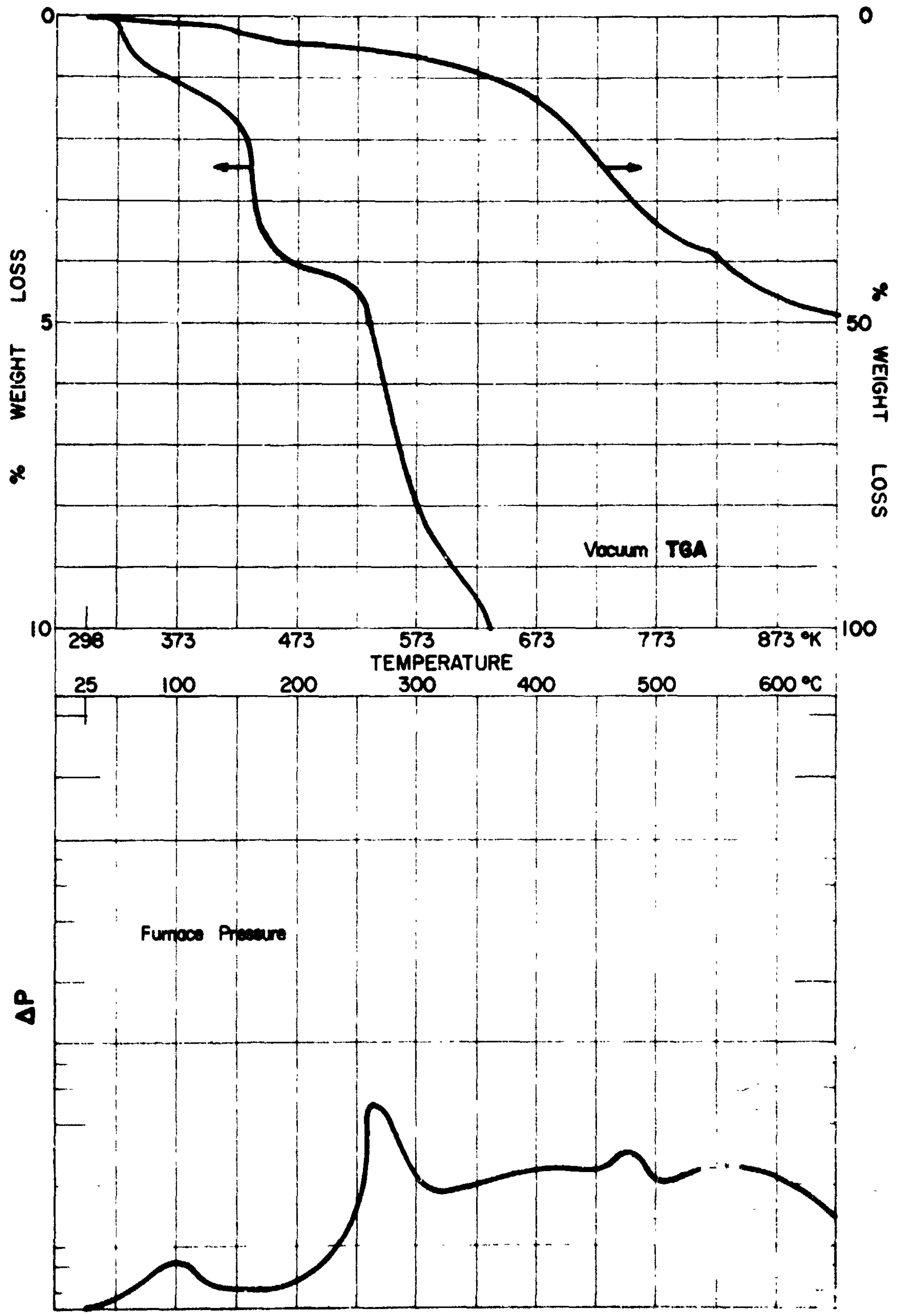
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^oK}\right) \ \min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	$4.5x10^4$	
100°C (373°K)	$1.8x10^2$	
150°C (423°K)	3	

Vel-Cro Pile Mil-F-21840C Class 2



MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	250	450	550	650		
14	866	1215	1457	1644	1816		
15	43	1353	1386	1735	3930		
16	1659	1806	10463	12563	14021		
17	11364	9918	31803	24404	19255		
18	45729	39044	100257	67593	34744		
19	164	80		287	174		
20	64	333	309	180	111		
21							
22			302	156			
23							
24			145	144	56		
25		224	1238	1080	396		
26	137	1671	7520	8415	8493'		
27	252	1605	10607	13404	33696		
28	24201	28433	61190	96450	34189		
29	473	1995	3030	3108	1602		
30	235	711	1283	1216	543		
31	163	719	515	570	370		
32	6784	6175	5879	6165	5234		
33				40	91		
34			112				
35		2426	92	60			
36		11481	1446	1211	661		
37		909	2414	4541	1553		
38		3789	5334	6534	2186		
39	57	1005	10933	12387	5163		
40	440	708	4755	4107	1769		
41	143	905	7358	4899	2318		
42	67	1835	3721	2953	968		
43	238	6114	2087	2890	1304		
44	1142	4871	80016	62343	3175		
45	89	4811	2165	1459	396		
46		87	316	343			
47			544	375			
48			84	255	47		
49		79	1180	2668	351		
50		916	6626	16201	1820		
51		949	7901	13521	4948		
52		701	5888	9152	3279		
53		40	5498	3983	654		
54			4401	3094	332		
55		295	2616	1989	674		
56		121	762	463	160		
57		65	282	168	134		
58			46				
59							
60		2475	910	559	138		
61		52	762	1540	188		
62			1172	2174	302		
63		67	2625	4618	1170		
64			2059	2783	403		
65			5575	4390	432		
66			7527	5842	433		
67			2429	1221	105		
68			547	250			
69			412	124			
70			103	95			
71			46				
72				54			
73		85	495	957	240		
74		72	1326	3095	903		
75			769	4842	1417		
76		48	1852	14204	4463		
77		822	6103	6699	2553		
78		3714	2878	10261	7169		
79		86	890	977	380		
80			11141	7230	831		
81			6444	3979	343		
82			430	164			
83				40			
84			66	114			
85			50	77			
86				66			
87		110	46	109			
88				200			
89			57	475			
90			125	766	55		
91			2117	4132	508		
92			1735	2770	210		

Vel-Cro Pile Mil-F-21840C Class 2

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, ^{o}C

m/e	25	250	450	550	650		
93				7822	423		
94			10888	508	59		
95							
96							
97							
98							
99				160			
100				105			
101				560	86		
102				280	40		
103			1285	18131	4636		
104			92	1231	169		
105			3848	1299	138		
106			333	331			
107			1155				
108				752			
109			11030	7153	564		
110			588	286			
111							
112							
113							
114							
115							
116			83				
117				210			
118				688			
119				89			
120							
121							
122							
123			1305	263			
124							
125							
126							
127							
128							
129				1130	79		
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: As received
Cure: ½ hr at 250°F (394°K) plus 1 hr at 300°F (422°K) plus ½ hr at 350°F (450°K) plus 4 hr at 500°F (533°K).

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate: 5.4×10^{-6} %/day

3. TGA Conditioning:

TGA Vacuum: 100 hr at 125°C (325°K) in N_2 atmosphere
Nitrogen: 24 hr at 23°C (296°K) and 45% RH

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 325°C-650°C (598°K-923°K)

a_o = 12% of initial weight

$$k = 3.4\times10^{2} \exp\left(\frac{-13700}{1.98\ T^{\circ}K}\right) \text{ min}^{-1}$$

In Nitrogen:

Over the range: 325°C-750°C (598°K-1023°K)

a_o = 30% of initial weight

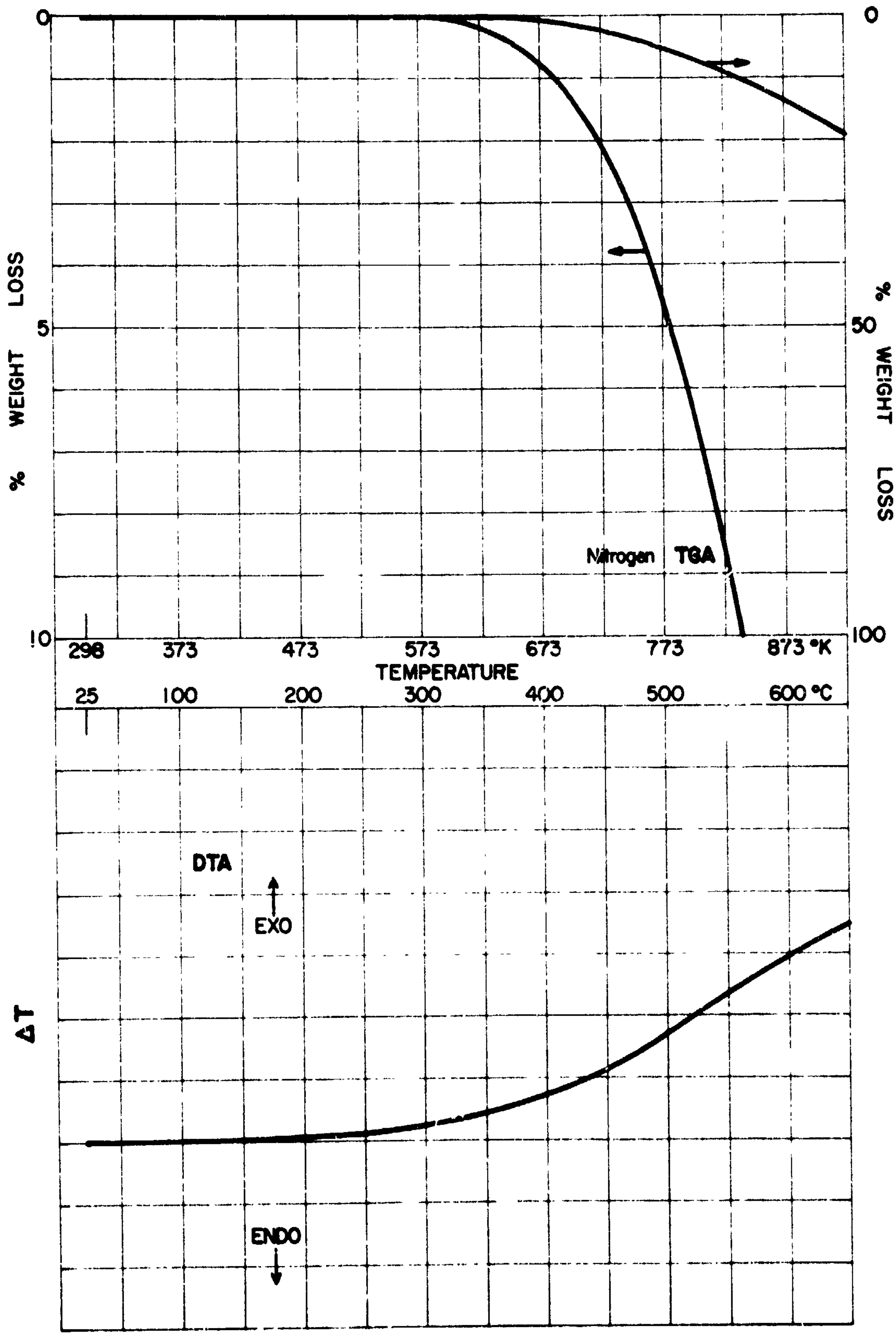
$$k = 88 \exp\left(\frac{-12200}{1.98\ T^{\circ}K}\right) \text{ min}^{-1}$$

Time to 1% Weight Loss at Temperature T

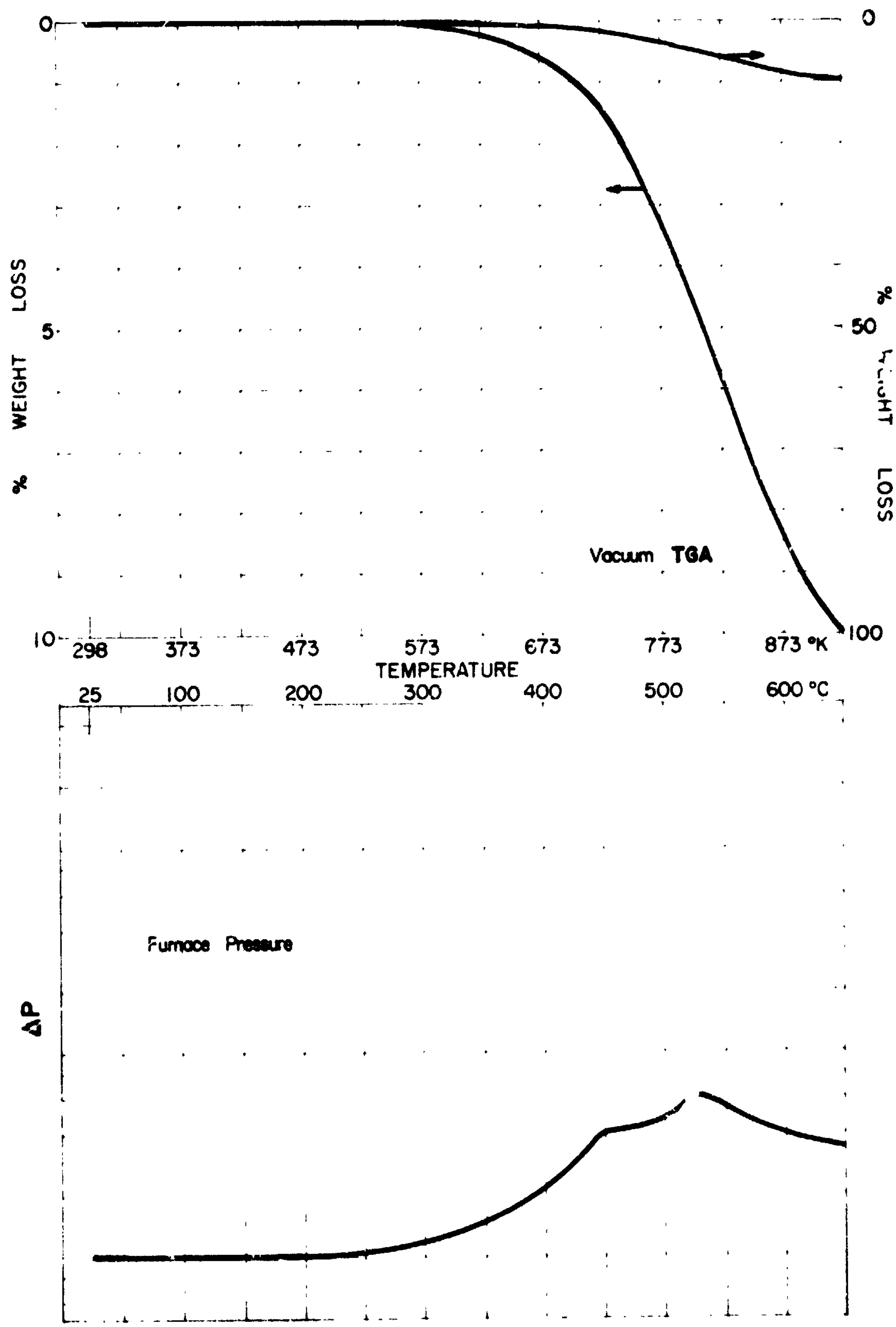
Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	3.6×10^{6}	1.3×10^{6}
100°C (373°K)	2.0×10^{5}	1×10^{5}
150°C (423°K)	2.2×10^{4}	1.4×10^{4}

PRECEDING PAGE BLANK NOT FILMED

Adlock 851



Ph2


% WEIGHT LOSS
0
5
10
% WEIGHT LOSS
0
50
100
Vacuum TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
Furnace Pressure
ΔP

Adlock 851

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	200	350	450	525	[illegible]	
14	133	121	119	134	208	[illegible]	
15				85	485	1916	
16	889	753	979	097	,739	3442	
17	6211	4586	4598	4946	4410	4145	
18	23086	17484	17007	18019	15864	14908	
19							
20							
21							
22							
23							
24							
25					55		
26				122	322	168	
27			45	110	402	251	
28	3825	3536	4094	4725	5956	6883	
29				49	90	60	
30	45	40	52	40	65	56	
31							
32	834	715	683	608	577	563	
33							
34							
35							
36							
37					42		
38					109	75	
39				36	212	290	
40	134	119	122	141	287	202	
41							
42							
43							
44	69	83	433	927	390	258	
45							
46							
47							
48							
49							
50					191	93	
51				43	226	137	
52					78		
53					131	45	
54							
55					67		
56							
57							
58							
59							
60							
61							
62							
63					92	58	
64							
65					159	80	
66					107	78	
67							
68							
69							
70							
71							
72							
73							
74							
75							
76							
77					201	40	
78					51	52	
79					117		
80							
81							
82							
83							
84							
85							
86							
87							
88							
89							
90							
91					52	79	
92							

Adlock 851

Table 1 Flexure Test (ASTM D790-66)*

Property (1)	Exposure	Average		High		Low		Samples Tested
		psi $\times10^{-4}$	Pa $\times10^{-8}$	psi $\times10^{-4}$	Pa $\times10^{-8}$	psi $\times10^{-4}$	Pa $\times10^{-8}$	
Ultimate Strength	Ambient	5.91	4.07	6.06	4.18	5.69	3.92	5
Ultimate Strength	Heat Compatibility (2)	5.01	3.45	5.15	3.55	4.86	3.35	5
Ultimate Strength	One Month Thermal Vacuum (3)	8.74	6.00	9.04	6.23	8.13	5.61	5
Modulus	Ambient	238	164	248	171	223	154	5
Modulus	Heat Compatibility	220	152	239	165	205	141	5
Modulus	One Month Thermal Vacuum (3)	225	155	232	160	214	148	5

*Procedure A, at a speed of 0.02 inch/minute with a 5/8 inch span using a 0.035x1x2 inch specimen.

(1) Cured 1/2 hour at 250°F (394°K) plus 1 hour at 300°F (422°K) plus 1/2 hour at 350°F (449°K) plus 4 hours at 500°F (533°K)

(2) Heat compatibility - 570 hours at 275°F (408°K) in N_2 atmosphere

(3) Thermal Vacuum - Tested at 1×10^{-5} Torr after heat compatibility (2) and an initial exposure of 10 to 16 hours at 140°F (333°K) to 160°F (344°K) followed by exposure at 120°F ± 10°F (322°K ± 6°K) for 1 month at a pressure of 1×10^{-6} Torr or less.

Table 2 Tension Test (ASTM D638-68)*

Property (1)	Exposure	Average		High		Low		Samples Tested
		psi $\times 10^{-4}$	Pa $\times 10^{-8}$	psi $\times 10^{-4}$	Pa $\times 10^{-8}$	psi $\times 10^{-4}$	Pa $\times 10^{-8}$	
Ultimate Strength	Ambient	2.67	1.84	2.79	1.92	2.56	1.77	5
Ultimate Strength	Heat Compatibility (2)	3.01	2.08	3.54	2.44	2.52	1.74	5
Modulus	Ambient	266	183	320	221	230	159	5
Modulus	Heat Compatibility (2)	257	177	304	210	228	157	5

*At a speed of 0.05 inch/minute using a dogbone type specimen of 0.018 inch thickness and 1/2 inch width in the gauge section.

(1) Cured 1/2 hour at 250°F (394°K) plus 1 hour at 300°F (422°K) plus 1/2 hour at 350°F (449°K) plus 4 hours at 500°F (533°K)

(2) Heat compatibility - 570 hours at 275°F (408°K) in N_2 atmosphere

Chemical Characterization Summary

Mix ratio: As received

Cure: Autoclave at 50 psi for 1 hr at 250°F(394°K) then 1 hr at 350°F (450°K)

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

   TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
   Nitrogen:

4. Activation Energy of Decomposition:

   In Vacuum:

   Over the range: 400°C-600°C (673°K-873°K)

   a_o = 11% of initial weight

   $$k = 2.2x10^3 \exp\left(\frac{-15900}{1.98\ T^oK}\right) \ min^{-1}$$

   In Nitrogen:

   Over the range:

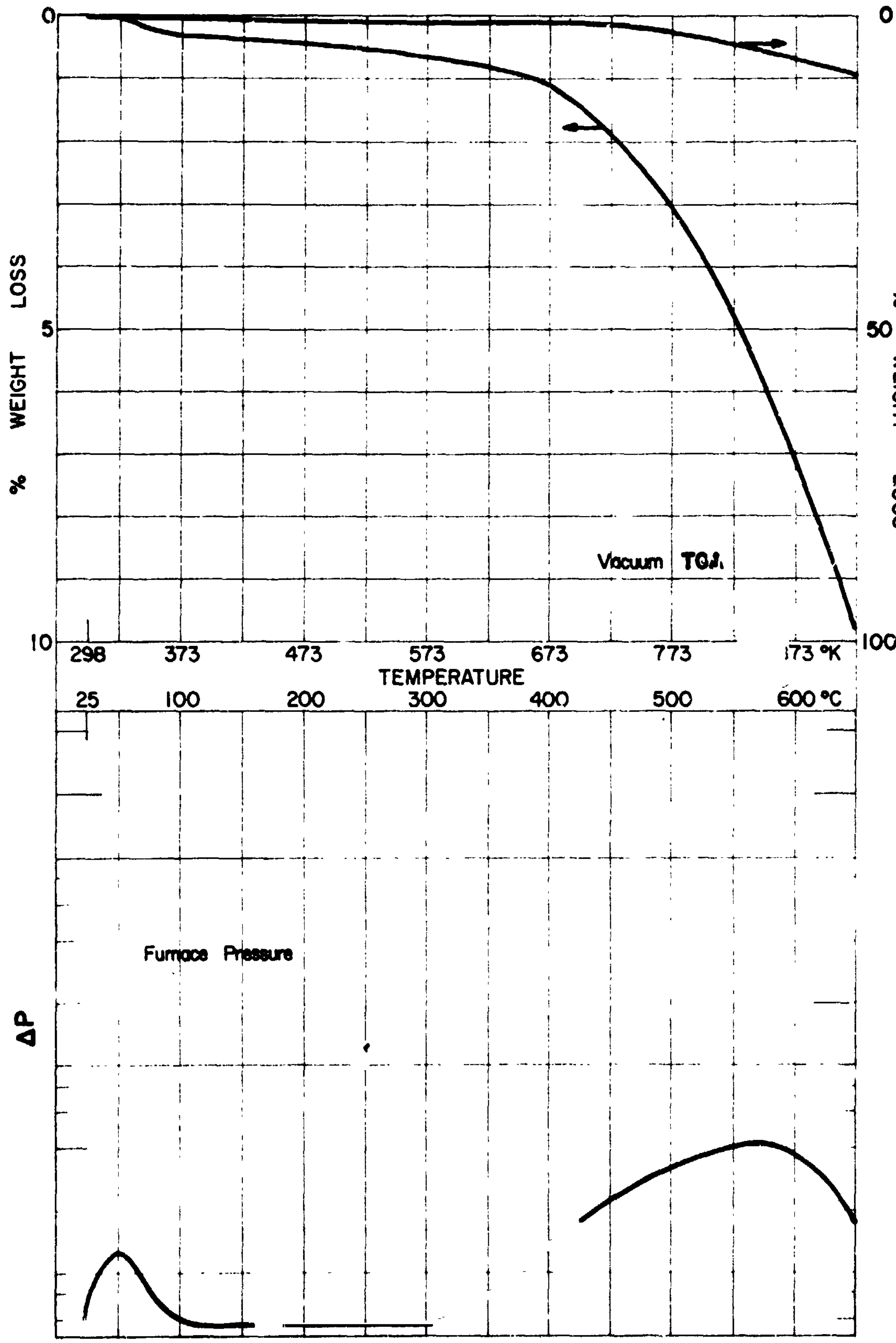
   a_o = of initial weight

   $$k = \quad \exp\left(\frac{-}{1.98\ T^oK}\right) \ min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	$1.7x10^7$	
100°C (373°K)	$6.2x10^5$	
150°C (423°K)	$4.8x10^4$	

F502/A120 Prepreg



Ph8

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, ^{o}C

m/e	25	350	500	600	700		
14	1140	1109	1261	2059	1641		
15	655	822	1174	5103	3170		
16	4276	3971	4338	9319	6964		
17	15676	12114	12662	12325	11108		
18	50676	36839	3900[illegible]	37478	33033		
19	210	296	230	194	178		
20	451	396	441	467	446		
21							
22							
23							
24			118	89	49		
25	64	85	378	290	121		
26	333	470	1726	1370	636		
27	520	726	1795	1379	840		
28	13873	13143	15949	21026	20303		
29	249	428	744	639	491		
30	632	716	667	732	721		
31		197	185	144	104		
32	3598	3244	3063	3070	3065		
33							
34							
35							
36			87	73			
37		48	473	339	64		
38		82	884	629	90		
39		218	2776	1908	293		
40	2987	2965	3844	3731	3241		
41	69	240	378	303	213		
42	72	180	230	186	145		
43	88	313	336	262	187		
44	803	913	1033	1192	1127		
45		520	95	129	66		
46			67	73			
47			155	93			
48			48	41			
49			231	174			
50		46	1122	843	123		
51		41	1397	1001	139		
52			607	484	90		
53			990	430	60		
54			234	107	40		
55		44	537	302	89		
56		49	62	59	62		
57			41		43		
58							
59							
60			91	51			
61			231	170			
62			377	289			
63			738	575	59		
64			2[illegible]5	173			
65	51	57	1223	962	98		
66	60	80	1459	865	113		
67			188	108	50		
68			104	74			
69							
70							
71							
72							
73			73	56			
74			215	169			
75			106	91			
76			94	111			
77			1603	770	97		
78			569	802	158		
79			1254	522	55		
80			416	152			
81			103	52			
82			42	42			
83							
84	106	94	107	116	113		
85							
86			55	62	43		
87							
88							
89			249	155			
90			441	181			
91			605	1474	68		
92			173	683			

F502/A120 Prepreg

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	350	500	600	700		
93			130	102			
94		46	1914	1055	89		
95			136	80			
96							
97							
98							
99							
100							
101							
102							
103			79	55			
104			53				
105			78	145			
106			63	188			
107			2091	618	41		
108			1629	538			
109			130	52			
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121			257	56			
122			416	101			
123			49				
124							
125							
126							
127							
128							
129	100	110	104	130	122		
130							
131	82	76	87	94	88		
132	99	94	100	115	101		
133							
134				40	41		
135							
136			49				
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Ph10

Chemical Characterization Summary

Mix ratio: As received film
Cure: As received

1. Isothermal Weight loss in Nitrogen: 1.05%

2. Steady-State Vacuum Condensible Degassing Rate: 9.7×10^{-5} %/day

3. TGA Conditioning:

TGA Vacuum: 100 hr at 125°C (398°K) in N_2 atmosphere
Nitrogen: 24 hr at 23°C (296°K) and 45% RH

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 430°C-580°C (703°K-853°K)

a_o = 43% of initial weight

$$k = 330 \exp\left(\frac{-19300}{1.98\ T^{o}K}\right) \text{ min}^{-1}$$

In Nitrogen:

Over the range: 430°C-550°C (703°K-823°K)

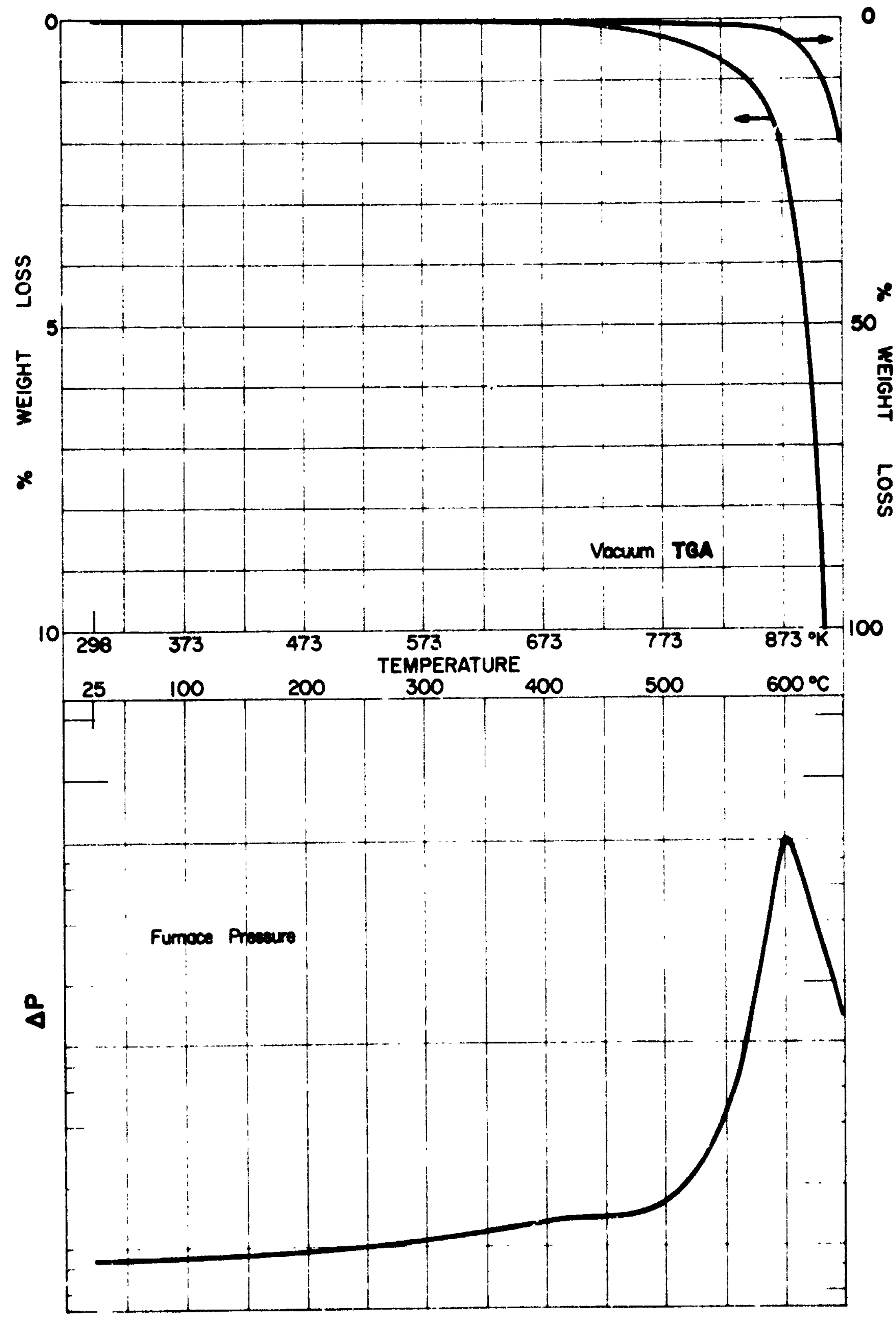
a_o = 34% of initial weight

$$k = 8 \times 10^{4} \exp\left(\frac{-26400}{1.98\ T^{o}K}\right) \text{ min}^{-1}$$

Time to 1% Weight Loss at Temperature T

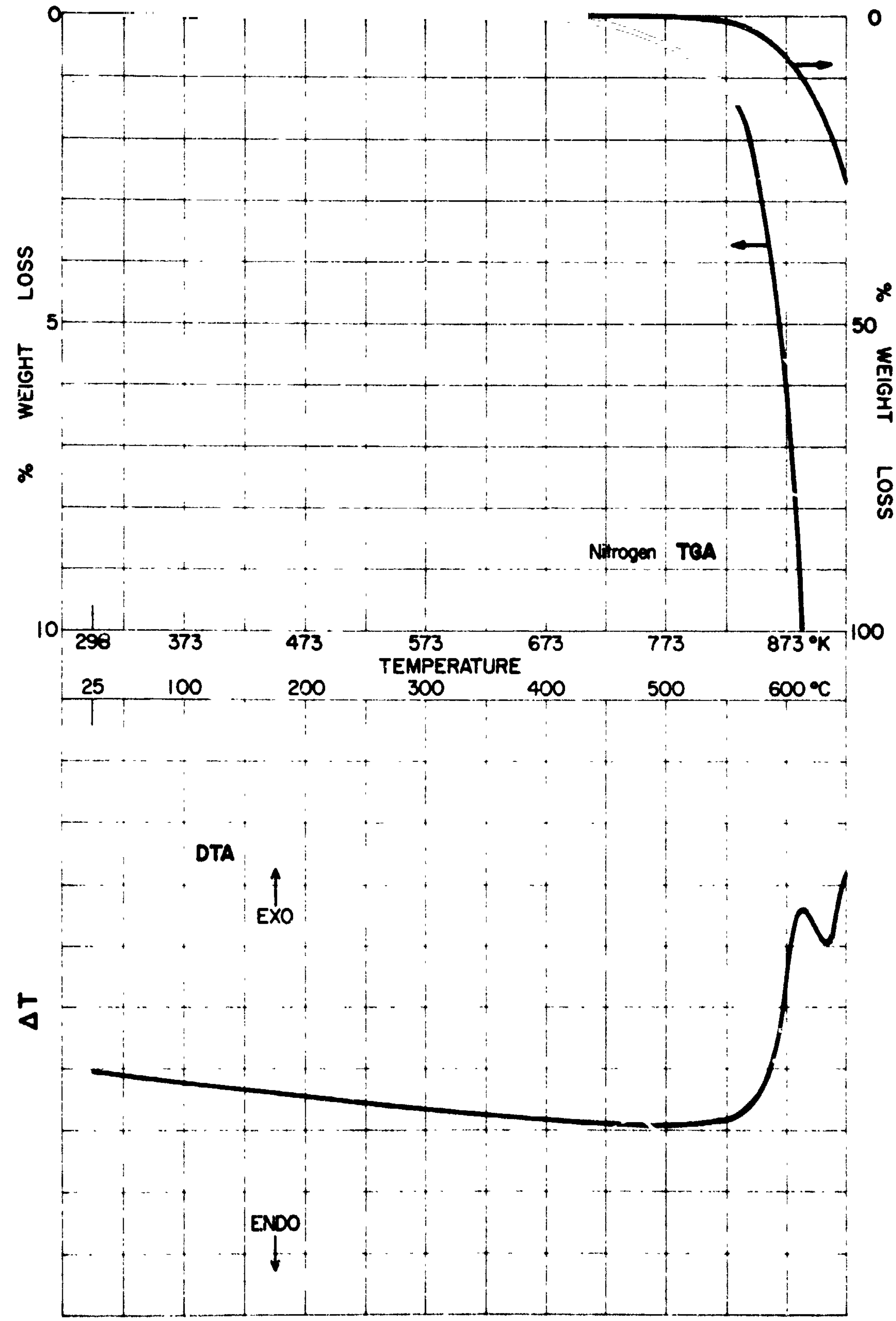
Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	2.4×10^{10}	6.6×10^{12}
100°C (373°K)	4.1×10^{8}	2.6×10^{10}
150°C (423°K)	1.8×10^{7}	3.6×10^{8}

Kapton H Film



Pi2

Kapton H Film



Kapton H Film

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	250	500	600	650		
14	459	509	642	943	1398		
15	41	69	122	283	1184		
16	2086	200[illegible]	2247	8409	12097		
17	9799	808[illegible]	7499	10723	16536		
18	33627	26749	24047	30374	35976		
19							
20				44	58		
21							
22				88	67		
23							
24							
25				68	84		
26			74	1027	2450		
27		64			8189		
28	7412	7483	9061	76677	78761		
29	40	44		857	1164		
30	166	207	229	559	683		
31							
32	1726	1609	1571	1510	1457		
33							
34							
35							
36							
37				82	294		
38				236	538		
39				941	1502		
40	413	472	528	1530	1717		
41				71	247		
42			46	44	192		
43							
44	170	217	1854	35633	28678		
45				252	217		
46				70	65		
47					40		
48							
49				41	115		
50				273	1047		
51				223	837		
52				89	428		
53					60		
54							
55				54	80		
56							
57							
58							
59							
60							
61					42		
62					68		
63				100	213		
64					77		
65				498	498		
66				848	834		
67							
68							
69							
70							
71							
72							
73							
74					73		
75					125		
76					491		
77					[illegible]72		
78				104	833		
79							
80							
81							
82							
83							
84							
85							
86							
87							
88							
89							
90							
91							
92							

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)
TEMPERATURE, °C

m/e	25	250	500	600	650		
93				337	149		
94				611	640		
95							
96							
97							
98							
99							
100							
101							
102							
103					323		
104							
105							
106							
107							
108							
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Polyimide (Porous)

Chemical Characterization Summary

Mix ratio: As received
Cure: As received

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition: Not amenable to analysis

In Vacuum:

Over the range:

a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \quad min^{-1}$$

In Nitrogen:

Over the range.

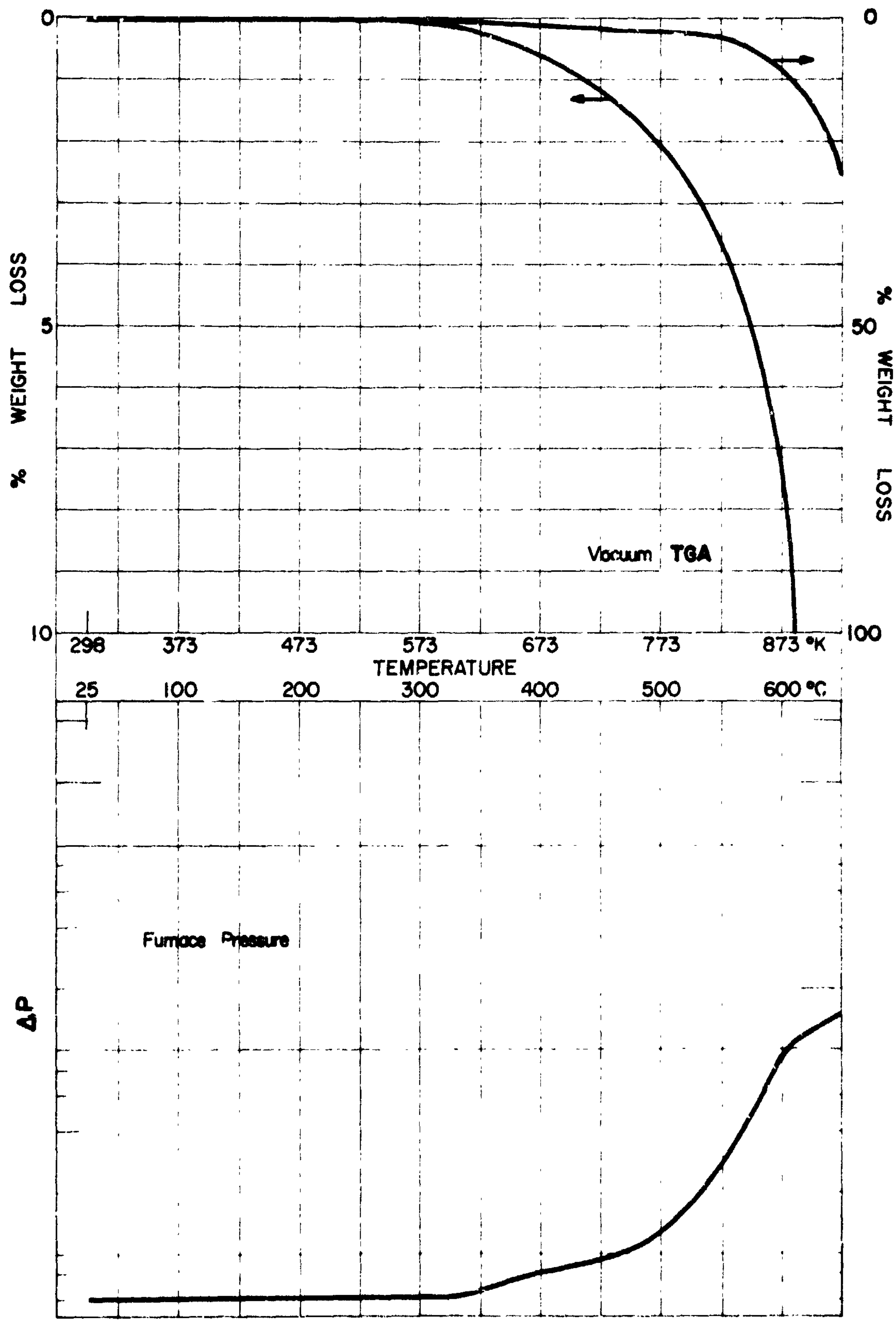
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \quad min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)		
100°C (373°K)		
150°C (423°K)		

Polyimide (Porous)



Pi7

Polyimide (Porous)

MASS NUMBER AND RELATIVE PEAK INTENSITY
TEMPERATURE, °C

m/e	25	200	400	650			
14	1278	1707	1143	2232			
15	348	436	309	1861			
16	2002	2947	2403	14843			
17	7373	9112	[illegible]14	13852			
18	27851	30559	25499	40834			
19		56	70	106			
20	210	293	222	522			
21				41			
22				411			
23							
24			59	276			
25	113	154	156	829			
26	745	1107	1118	6885			
27	952	1448	1466	19274			
28	35477	51186	40600	101913			
29	787	1250	1091	6695			
30	535	846	778	2057			
31	100	125	413	302			
32	5727	8201	6178	6820			
33							
34				59			
35							
36		42		110			
37				721			
38	50	44		1259			
39	138	252	235	2067			
40	3022	4654	3320	7933			
41	192	262	289	1174			
42	15[illegible]	179	347	2300			
43	1233	1702	1546	9494			
44	988	1242	5219	65490			
45	42	67	167	1018			
46				262			
47							
48				43			
49				344			
50				1795			
51			40	1624			
52				1011			
53				152			
54				62			
55				191			
56				63			
57	41	53	46	91			
58				86			
59							
60							
61				91			
62				79			
63				266			
64				223			
65				187			
66				292			
67				54			
68							
69							
70							
71							
72	[illegible]	[illegible]		66			
73				40			
74				132			
75				137			
76				631			
77				342			
78				901			
79							
80							
81							
82							
83							
84							
85							
86							
87							
88							
89							
90							
91							
92							

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	200	400	650			
93				90			
94							
95							
96							
97							
98							
99							
100							
101							
102							
103				178			
104							
105							
106							
107							
108							
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125							
126							
127							
[illegible]							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Polythermaleze Wire Insulation

Chemical Characterization Summary

Mix ratio: As received.
Cure: As received.

1. Isothermal Weight loss in Nitrogen: 0.03%

2. Steady-State Vacuum Condensible Degassing Rate: 8.59×10^{-5} %/day

3. TGA Conditioning:

TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 350°C-450°C (623°K-723°K)

a_o = 41% of initial weight

$$k = 8.9 \times 10^{12} \exp\left(\frac{-38600}{1.98\ T^{\circ}K}\right) \ \text{min}^{-1}$$

In Nitrogen:

Over the range:

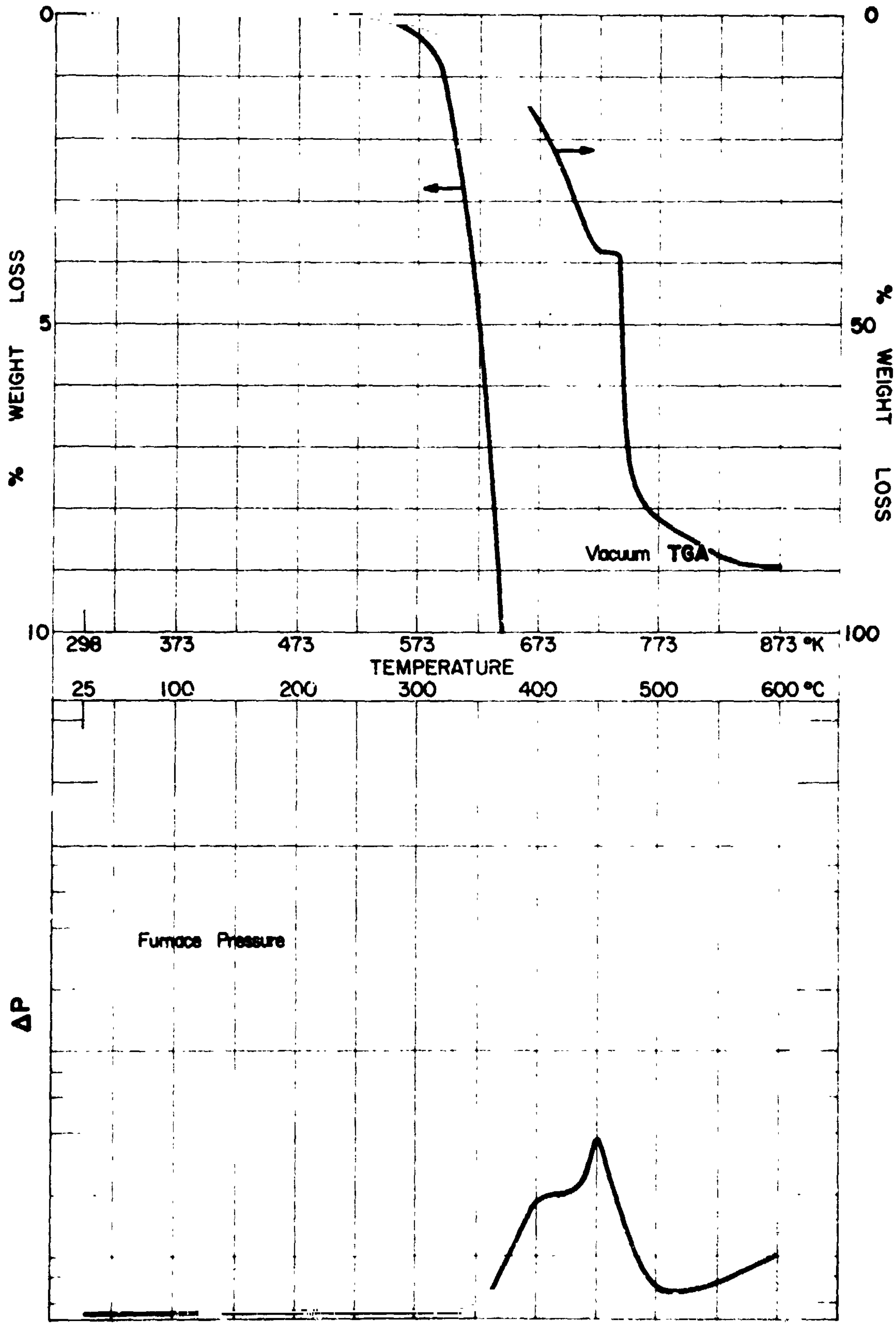
a_o = of initial weight

$$k = \exp\left(\frac{-}{1.98\ T^{\circ}K}\right) \ \text{min}^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	9.4×10^{13}	
100°C (373°K)	3.2×10^{10}	
150°C (423°K)	6.9×10^{7}	

Polythermaleze Wire Insulation



Polythermaleze Wire Insulation

MASS NUMBER AND RELATIVE PEAK INTENSITY
TEMPERATURE, °C

m/e	25	250	350	450	550		
14	1774	1757	1972	3856	2045		
15	248	309	904	5733	1111		
16	3018	2716	3303	17146	4671		
17	12644	10050	9266	15159	9416		
18	43233	33102	30569	31891	27568		
19	78	83	85	88	69		
20	192	174	201	309	193		
21							
22			45	769			
23							
24			45	279	44		
25			154	1009	152		
26	172	225	719	6790	1119		
27				9122			
28	19455	18874	20559	48608	28964		
29	267	368	1547	7774	654		
30	406	432	480	1669	565		
31		47			48		
32	4693	4246	4091	3947	3892		
33							
34							
35							
36				158			
37				1178	124		
38			48	1836	208		
39	49		162	3755	587		
40	1378	1338	1462	4110	1604		
41	49	79	156	3026	302		
42	44	63	217	5798	164		
43	68	123		17302			
44	493	729	5423	72916	3262		
45				1178	103		
46							
47							
48				66			
49				606	53		
50			107	3488	416		
51			99	3698	450		
52			52	1552	204		
53				710	51		
54				657			
55				486	41		
56				3403			
57				717			
58				47			
59							
60				80			
61				229			
62				317			
63				733	101		
64				370	40		
65				553	115		
66				379	143		
67				272			
68				166			
69				323			
70				166			
71				1221			
72				56			
73				136			
74				481	43		
75				652	43		
76				1667	114		
77			49	1829	217		
78			74	890	302		
79				233			
80				173			
81				40			
82				45			
83							
84	44	54	59	149	53		
85							
86				43			
87				51			
88							
89				146			
90				117			
91				931	157		
92				382	73		

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	250	350	450	550		
93				202	119		
94				64			
95				43			
96							
97							
98							
99							
100							
101				75			
102				43			
103				1216	68		
104				142			
105				526			
106				64			
107							
108							
109							
110							
111							
112							
113							
114							
115							
116							
117				76			
118							
119							
120							
121							
122				43			
123				49			
124							
125							
126							
127							
128				43			
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: Single component
Cure: 0.5 hr at 200°F (376°K), plus 1 hr at 350°F (440°K),
plus 1 hr at 450°F (505°K), plus 1 hr at 500°F (533°K)

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate·

3. TGA Conditioning:

TGA Vacuum: 24 hr min at 23°C (296°K) and 45% RH
TGA Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 100°C-370°C (373°K-643°K)

a_o = 4% of initial weight

$$k = 136 \quad \exp\left(\frac{-7860}{1.98\ T^{\circ}K}\right) \quad min^{-1}$$

In Nitrogen:

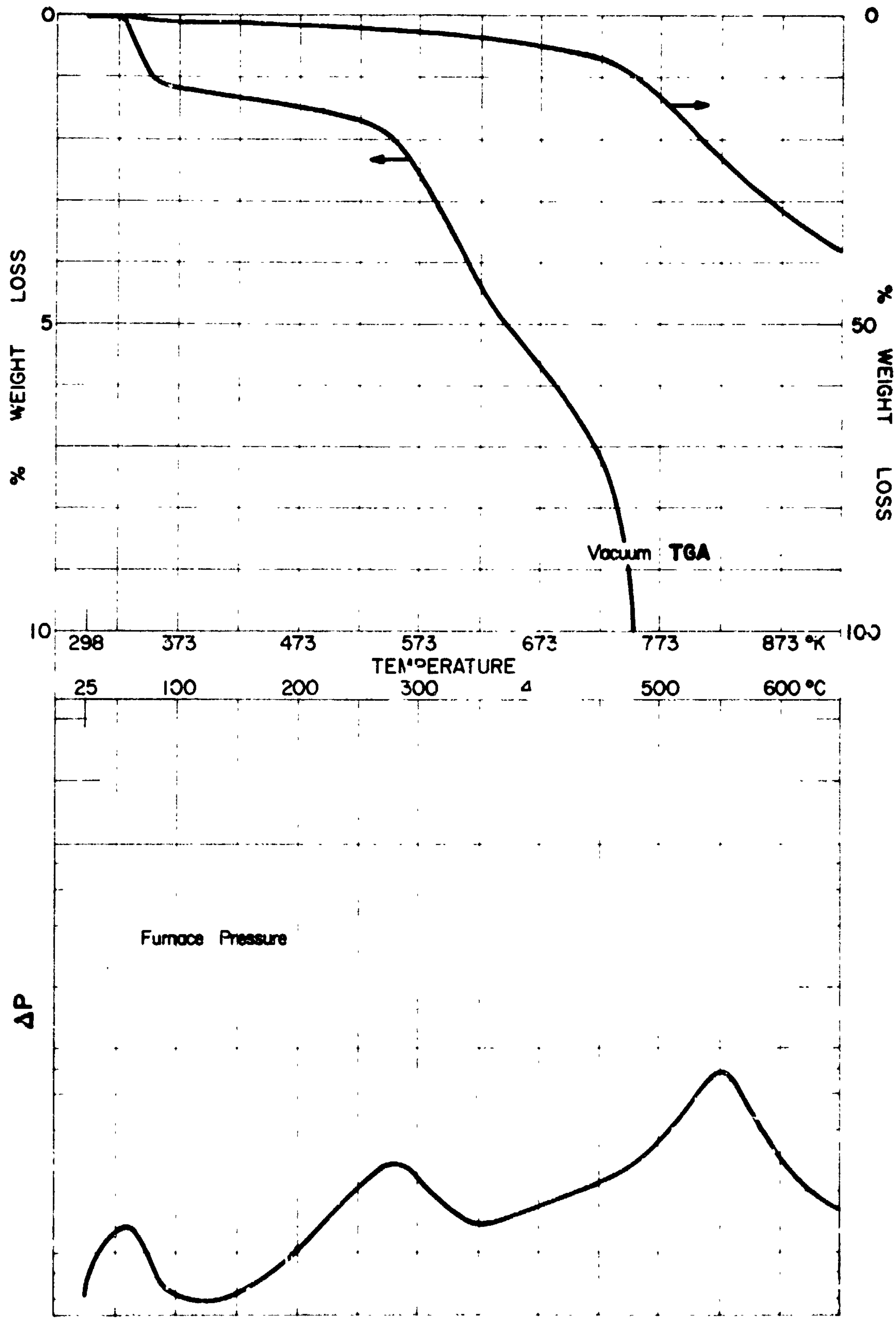
Over the range:

a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{\circ}K}\right) \quad min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	9.7×10^2	
100°C (373°K)	1.9×10^2	
150°C (423°K)	52	


0
5
10
% WEIGHT LOSS
0
50
100
% WEIGHT LOSS
Vacuum TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
500
600 °C
Furnace Pressure
ΔP

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	250	450	550	700		
14	2688	4138	2967	4014	5276		
15	907	5989	1371	3489	10584		
16	8106	8418	14410	27667	28620		
17	26766	23400	26089	36822	32245		
18	82309	70066	77791	82667	59373		
19	354	391	396	408	343		
20	541	590	692	873	681		
21							
22			391	581			
23							
24		97	51	425	67		
25		382	212	1426	259		
26	424	1854	1412	8773	3472		
27	906	4166	1721	11616	11992		
28	28360	31765	55610	[illegible]	44543		
29	399	1661	789	1982	1247		
30	1711	2296	2166	3321	2402		
31	43	337	80	230	164		
32	8032	8832	9008	8424	7627		
33		792	375	91	56		
34		873	918	293	167		
35		3067					
36		104	97		128		
37		140	68	3826	228		
38		89	[illegible]	6108	359		
39	61	214	[illegible]	13139	935		
40	4421	4567	[illegible]	9668	5648		
41	62	196	279	3498	834		
42		169	149	1198	413		
43	75	355			719		
44	1572	3407	48065	73533	4885		
45		11575	718	1379	188		
46		4610	232	1597			
47		7732	161				
48		3373	215	339	40		
49		590		1908	105		
50		432	194	10169	691		
51		70	225	8722	452		
52		50	148	6786	285		
53			62	2375	155		
54			60	2222	98		
55				169	226		
56		30		69	149		
57		243		41	79		
58		400					
59		510					
60		477	257	318			
61		10130	55	1494	50		
62		[illegible]	42	2193	71		
63		2269	81	4446	156		
64		647	203	2047	128		
65		94	290	7569	158		
66		62	495	11984	190		
67			56	1637	116		
68				72			
69							
70							
71							
72							
73				559			
74				1913	127		
75		96		2312	124		
76		689	261	667	442		
77		132	103	4499	244		
78		1219	96	6698	407		
79		1320		[illegible]	[illegible]		
80		69		[illegible]			
81		66		1			
82					41		
83							
84		56	54	122	106		
85				54			
86				130			
87				103			
88				149			
89				609			
90				481			
91				4577	93		
92		67	74	4760			

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	250	450	550	700		
93		97	723	19072	82		
94		1274		1474	66		
95							
96		70					
97							
98							
99				89			
100				61			
101				222			
102				195			
103				8283	198		
104				1031	114		
105				146			
106			273	6715	66		
107			144	4621			
108		2420		288			
109		77					
110		162					
111							
112							
113							
114							
115							
116				164			
117				335			
118					41		
119							
120							
121							
122							
123							
124							
125							
126							
127							
128				573			
129		51	75	141	92		
130							
131		41	48	71	55		
132		43	61	98	67		
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Vespel SP-1

Chemical Characterization Summary

Mix ratio: As received sheet stock
Cure: As received

1. Isothermal Weight loss in Nitrogen: 0.93%

2. Steady-State Vacuum Condensible Degassing Rate: 4.3×10^{-5} %/day

3. TGA Conditioning:

TGA Vacuum: 100 hr at 125°F (324°K) in N_2 atmosphere
Nitrogen: 24 hr at 23°C (296°K) and 45% RH

4. Activation Energy of Decomposition:

In Vacuum: not amenable to analysis

Over the range:

$a_o =$ of initial weight

$$k = \exp\left(\frac{-}{1.98\ T^{o}K}\right)\ \text{min}^{-1}$$

In Nitrogen:

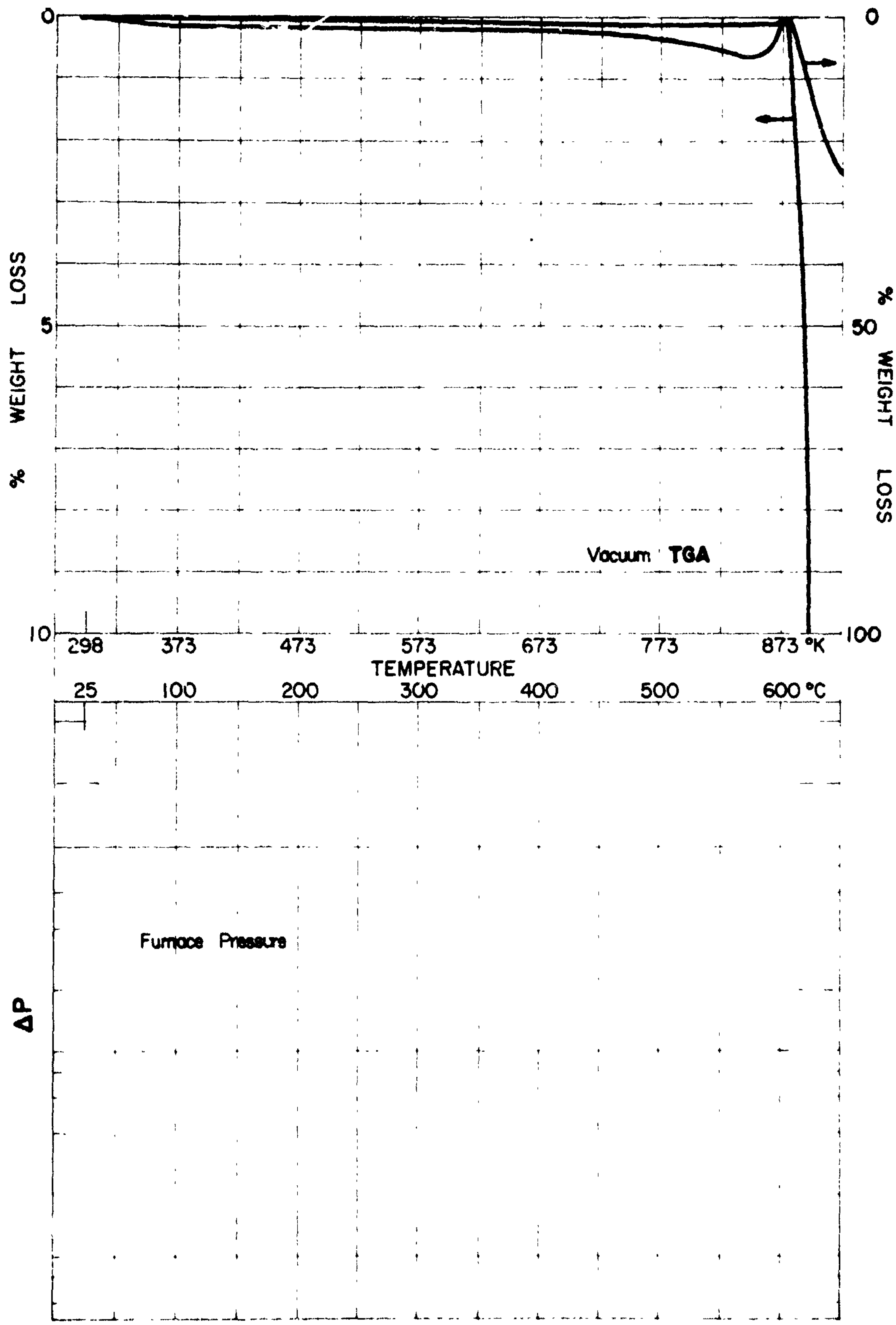
Over the range: 500°C-570°C (773°K-843°K)

a_o = 40% of initial weight

$$k = 3\times10^{12}\ \exp\left(\frac{-\ 54900}{1.98\ T^{o}K}\right)\ \text{min}^{-1}$$

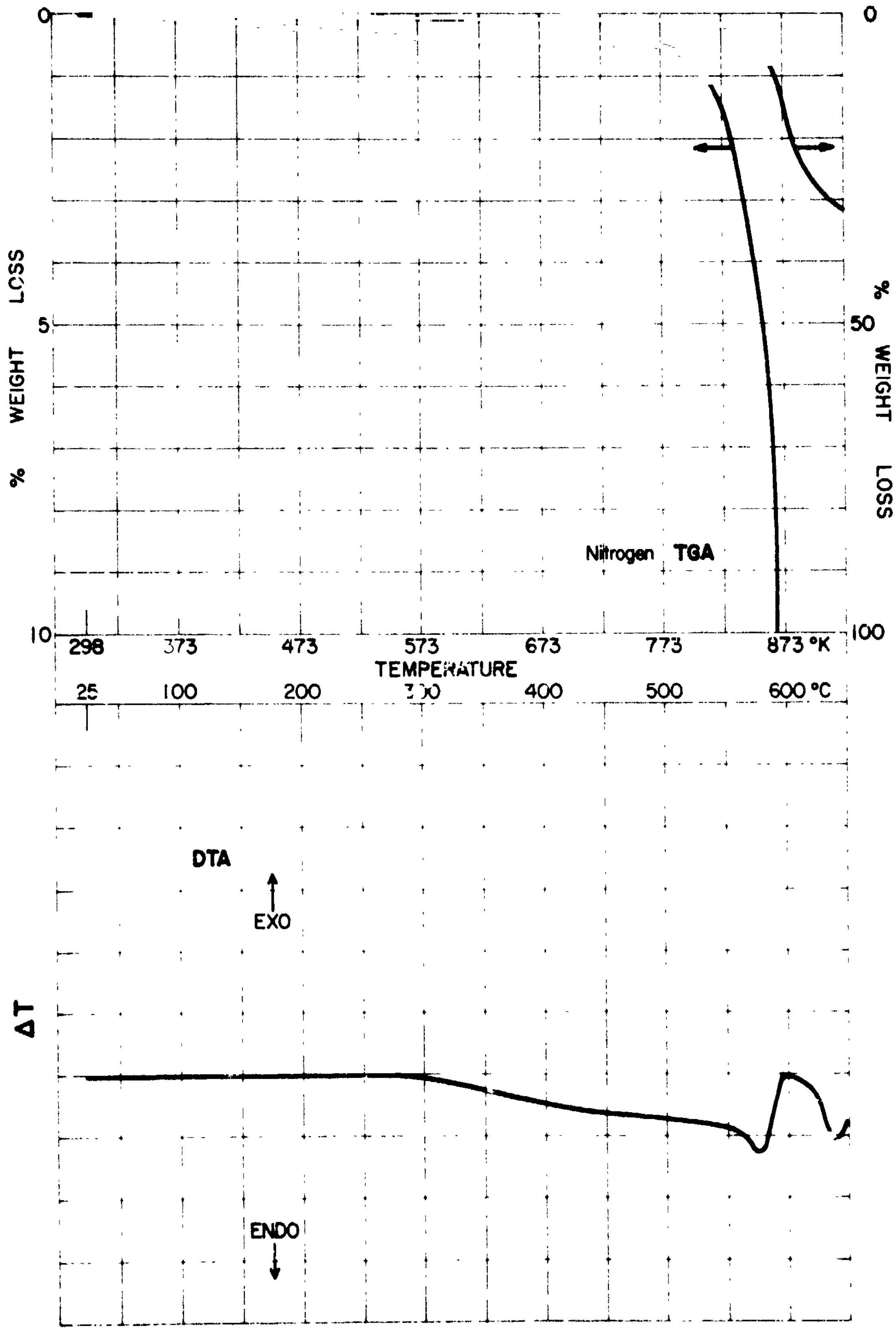
Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)		4.1×10^{24}
100°C (373°K)		4.0×10^{19}
150°C (423°K)		5.7×10^{15}



0
5
10
% WEIGHT LOSS
0
50
100
% WEIGHT LOSS
Vacuum TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
ΔP
Furnace Pressure

Vespel SP-1



P120

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	300	550	600	650		
14	372	429	478	965	1068		
15	157	140	166	383	2228		
16	2262	2175	2759	15820	14138		
17	10918	9323	9044	11913	21119		
18	38707	31472	29663	36862	41490		
19	40	52	48	40	50		
20	65	71	67	132	98		
21							
22				478	53		
23							
24							
25				115	84		
26	139	96	138	1157	1594		
27	188	189	200		4859		
28	10533	10119	15653	100357	51506		
29	180	154	165	1272	628		
30	406	447	525	1173	763		
31	45	57	62	73	63		
32	2038	1922	1897	2198	1800		
33							
34							
35							
36							
37				95	110		
38				201	163		
39	78	71	59	762	680		
40	978	895	993	2847	1586		
41	131	97	95	171	274		
42		41		87	97		
43	90	96	87		292		
44	299	288	6042	100346	19462		
45			46	1117			
46				327	44		
47				54			
48							
49				59	62		
50				287	384		
51				247	317		
52				127	189		
53				40	47		
54							
55	63	68	45	109	74		
56	40	43					
57	44	43					
58							
59							
60							
61				41			
62				45	45		
63				107	87		
64				57	50		
65				327	147		
66				649	286		
67				50	45		
68							
69	41						
70							
71							
72							
73							
74				46	62		
75				50	55		
76				119	202		
77				75	86		
78				255	425		
79							
80							
81							
82							
83							
84							
85							
86							
87							
88							
89							
90							
91							
92				46			

V SP-1

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	300	550	600	650		
93				188	91		
94				499	139		
95				41			
96							
97							
98							
99							
100							
101							
102							
103				70	102		
104							
105							
106							
107							
108							
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

C-3

Table 1 Tensile Test (ASTM D638-68)*

Property	Exposure	Average		High		Low		Samples Tested
		psi x10^{-4}	Pa x10^{-8}	psi x10^{-4}	Pa x10^{-8}	psi x10^{-4}	Pa x10^{-8}	
Ultimate Strength	Ambient	1.80	1.24	1.87	1.29	1.71	1.18	5
Ultimate Strength	Heat compatibility (1)	1.86	1.28	1.91	1.32	1.76	1.21	5
Ultimate Strength	30 day thermal vacuum (2)	1.80	1.24	1.92	1.32	1.64	1.13	5
		%		%		%		
Elongation	Ambient	9.39		12.90		7.80		5
Elongation	Heat compatibility(1)	11.53		11.55		9.70		5
Elongation	Heat compatibility (1) plus 30 day thermal vacuum (2)	10.90		12.80		9.50		5

* At a speed of 0.20 inch/minute using a Type IV specimen.
(1) Heat compatibility - 570 hours at 275°F (408°K) in N_2 atmosphere.
(2) Tested at 1x10^{-5} Torr after exposure for the specified length of time at 150°F (338°K) at 1x10^{-5} Torr.

Table 2. Flexural Strength @ 5% Strain (ASTM D790)*

Exposure	Average		High		Low		Samples Tested
	psi $\times 10^{-4}$	Pa $\times 10^{-8}$	psi $\times 10^{-4}$	Pa $\times 10^{-8}$	psi $\times 10^{-4}$	Pa $\times 10^{-8}$	
Baseline	1.92	1.32	1.98	1.37	1.86	1.28	5
Heat compatibility (1)	1.97	1.36	2.10	1.45	1.88	1.30	5
Heat compatibility (1) plus 30 day thermal vacuum (2)	2.00	1.38	2.12	1.46	1.89	1.30	5

* Procedure A, Method I at a speed of 0.03 inch/minute with a 1.0 inch span using a 0.062x1x2 inch specimen.

(1) Heat compatibility - 570 hours at 275°F (408°K) in N_2 atmosphere.

(2) Tested at 1×10^{-5} Torr after exposure for the specified length of time at 150°F (338°K) and 1×10^{-6} Torr.

Table 3. Hardness (ASTM D785 and D2240)

Exposure	Average		High		Low		Samples Tested
	Rockwell M	Shore D*	Rockwell M	Shore D*	Rockwell M	Shore D*	
Baseline	88.2	86	89.0	86	87.0	85	5
Heat compatibility (1)	90.0	86	92.0	36	89.0	86	5
Tested in air after heat compatibility (1) plus 30 day thermal vacuum (2)	89.6		91.0		87.0		5
Tested at $1x10^{-5}$ Torr after heat compatibility (1) plus 30 day thermal vacuum (2)		85		86		85	5

*Shore D Harndess was run as compaison since Rockwell Tester could not be used In-Situ. Thermal vacuum test specimens were tested for Rockwell Hardness in air after Shore D test in vacuum.

(1) Heat compatibility - 570 hours at 275°F (408°K) in N_2 atmosphere.

(2) Exposed for the specified length of time to 150°F (338°K) and $1x10^{-6}$ Torr.

Table 4. Dielectric Strength* (ASTM D149-70)

Exposure	Nominal Thickness		Average		High		Low		Samples Tested
	mil	m $\times 10^{-3}$	Volts/m $\times 10^{7}$	Volts/mil	Volts/m $\times 10^{7}$	Volts/mil	Volts/m $\times 10^{7}$	Volts/mil	
Baseline	62	1.6	2.7	676	2.8	704	2.6	654	5
Heat compatibility (1)	62	1.6	2.6	666	2.9	742	2.4	622	5
Heat compatibility (1) plus 30 day thermal vacuum (2)	62	1.6	1.9	469	2.1	524	1.5	388	5

(1) 570 hours at 275°F (408°K) in N_2 atmosphere

(2) Tested at 1×10^{-5} Torr after exposure for the specified length of time at 150°F (338°K) and 1×10^{-6} Torr.

Table 5. Surface Resistivity (ASTM D257)
@ 1000 VDC

Exposure	Average (OHM-CM)	High (OHM-CM)	Low (OHM-CM)	Samples Tested
Baseline	4.67×10^{14}	4.5×10^{14}	4.0×10^{14}	3
Heat compatibility (1)	2.33×10^{14}	2.5×10^{14}	2.0×10^{14}	3
Heat compatibility (1) plus 30 day thermal vacuum (2)	1.71×10^{14}	1.89×10^{14}	1.52×10^{14}	3

Table 6. Volume Resistivity (ASTM D257)
@ 1000 VDC

Baseline	6.67×10^{14}	1.0×10^{15}	5.0×10^{14}	3
Heat compatibility (1)	2.83×10^{14}	5.0×10^{14}	1.5×10^{14}	3
Heat compatibility (1) plus 30 day thermal vacuum (2)	3.01×10^{14}	3.14×10^{14}	2.74×10^{14}	3

(1) Heat compatibility - 570 hours at 275°F (408°K) in N_2 atmosphere.

(2) Tested at 1×10^{-5} Torr after exposure for the specified length of time at 150°F (338°K) and 1×10^{-6} Torr.

Table 7. Dielectric Constant (ASTM D150) @ 1 MHZ

Exposure	Average	High	Low	Samples Tested
Baseline	2.94	2.98	2.90	3
Heat compatibility (1)	2.91	2.96	2.84	3
Heat compatibility (1) plus 30 day thermal vacuum (2)	2.87	2.92	2.84	3

Table 8. Dissipation Factor (ASTM D150) @ 1 MHZ

Baseline	0.00046	0.00047	0.00046	3
Heat compatibility (1)	0.00109	0.0011	0.00106	3
Heat compatibility (1) plus 30 day thermal vacuum (2)	0.00016	0.00016	0.00015	3

(1) Heat compatibility - 570 hours at 275^{o}F (408^{o}K) in N_2 atmosphere.

(2) Tested at 1x10^{-5} Torr after exposure for the specified length of time at 150^{o}F (338^{o}K) and 1x10^{-6} Torr.

Chemical Characterization Summary

Mix ratio: As Received
Cure: As Received

1. Isothermal Weight loss in Nitrogen: 0.13%

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 25°C-400°C (298°K-673°K)

a_o = 10% of initial weight

$$k = 76 \quad \exp\left(\frac{-7740}{1.98\ T^{o}K}\right) \quad min^{-1}$$

In Nitrogen:

Over the range:

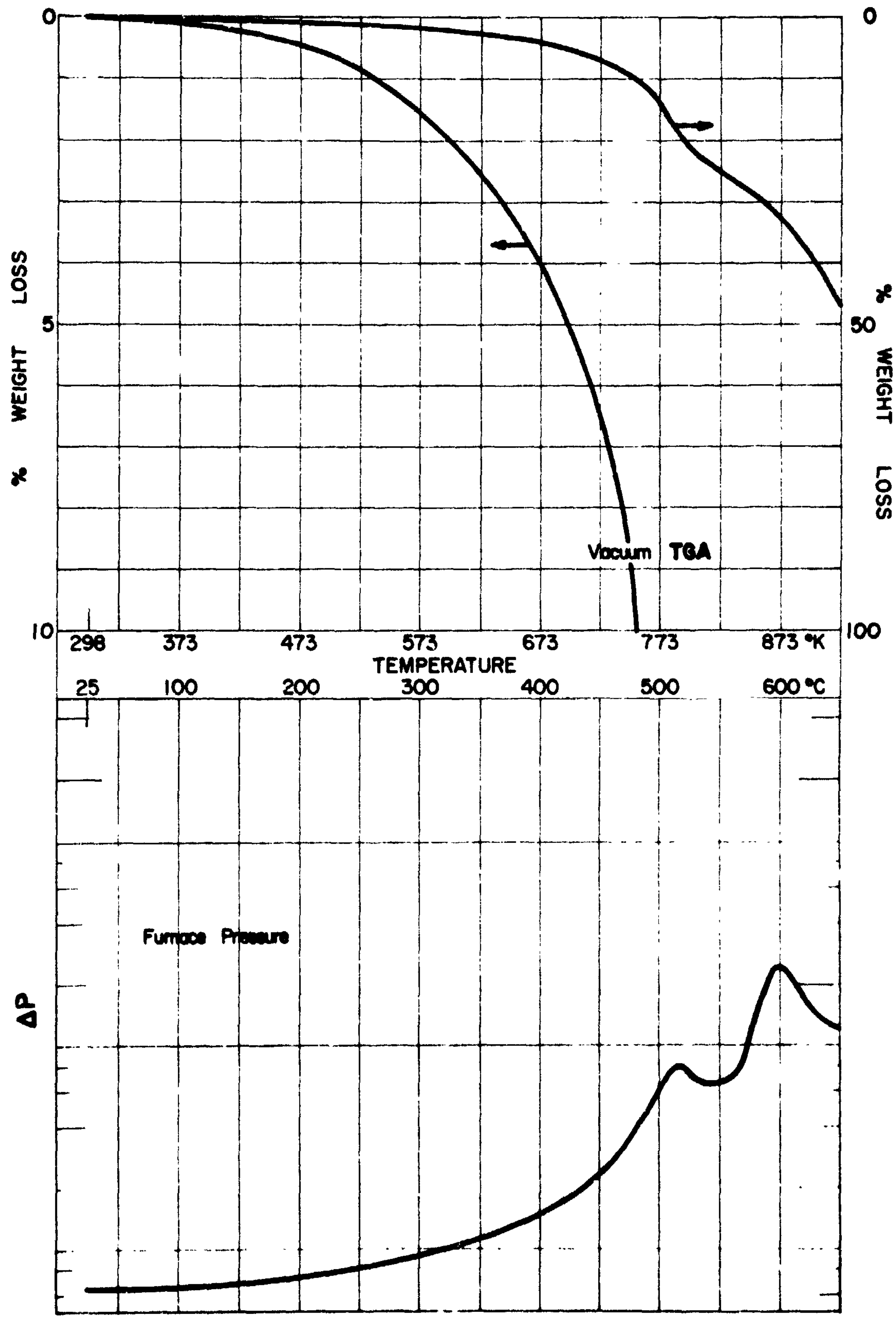
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \quad min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	1.4×10^3	
100°C (373°K)	2.8×10^2	
150°C (423°K)	81	

#92 Tape


0
5
10
% WEIGHT LOSS
0
50
100
% WEIGHT LOSS
Vacuum TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
Furnace Pressure
ΔP

P130

#92 Tape

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	200	400	500	600		
14	3249	3026	4829	8629	9795		
15	1680	1750	5664	16068	17327		
16	11618	10890	11304	13940	51707		
17	37397	31490	26808	23676	45916		
18	100778	97875	81988	69577	372230		
19	877	1014	1206	1247	1101		
20	1001	1026	972	995	1724		
21							
22					1422		
23							
24			102	480	853'		
25	108	101	431	1615	2817		
26	863	793	2217	7181	14980		
27	1492	1426	2229	4503	18071		
28	39176	39147	39669	49188	1004040		
29	686	751	1476	2671	7940		
30	1646	1674	1910	1847	3799		
31	101	105	203	370	815		
32	9913	9352	8434	7326	9810		
33					119		
34	43				82		
35							
36	40		44	113	410		
37			70	412	2342		
38		50	138	602	3837		
39		179	475	1944	9570		
40	7289	7342	7369	7759	17930		
41	166	167	532	1615	2270		
42	145	151	603	1332	2146		
43	208	244	934	1340			
44	2217	2378	3563	5732	517150		
45	51	126	2839	3529	9242		
45			197	211	1394		
47			1403	817	4150		
48			52	69	420		
49			70	206	1229		
50			125	701	4435		
51			115	789	3909		
52			88	789	2524		
53			72	156	1248		
54				52	759		
55			86	159	1570		
56			78	84	278		
57			68	148	296		
58			51	268	329		
59			366	2117	2282		
60			174	245	700		
61			365	850	2322		
62				80	1330		
63			51	193	2496		
64	90		73		1182		
65		90	91	203	5667		
66	104	40	139	759	9222		
67	40		42	133	1123		
68			42	49	328		
69					97		
70					312		
71				136	223		
72					459		
73			570	12350	9049		
74			231	1313	2120		
75		158	7775	3907	18631		
76			557	352	2952		
77			473	893	2917		
78			255	1805	3934		
79				145	619		
80					160		
81			48	446	605		
82			49	241			
83				86	172		
84	205	179	177	187	560		
85				109	167		
86	58		40	77	234		
87				591	670		
88				273	401		
89			55	803	984		
90			51	91	361		
91				355	1284		
92				74	1102		

#92 Tape

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	200	400	500	600		
93				48	5729		
94					8408		
95					629		
96			304	4099	4372		
97			43	475			
98					44		
99					59		
100					750		
101				61	220		
102				129	275		
103			58	1015	3046		
104				200	406		
105				323	419		
106				40	130		
107					133		
108					50		
109					83		
110							
111					52		
112							
113					40		
114							
115				432	553		
116				52	127		
117				253	278		
118				62	101		
119				671	1021		
120				61	105		
121				59	104		
122							
123							
124							
125				64	85		
126							
127							
128					296		
129	205	125	210	240	619		
130					83		
131	156	130	146	319	557		
132	194	163	182	266	620		
133			113	1649	1867		
134	52	53	71	260	380		
135				134	214		
136	49			67	151		
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147				1240	806		
148				139	106		
149				123	240		
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163				57	83		
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: 100 pbw of A to 26 pbw of B
Cure: 2 hr at 250°C (523°K)

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 180°C-380°C (453°K-653°K)

a_o = 82% of initial weight

$$k = 1.1 \times 10^{15} \exp\left(\frac{-40000}{1.98\ T^\circ K}\right) \quad min^{-1}$$

In Nitrogen:

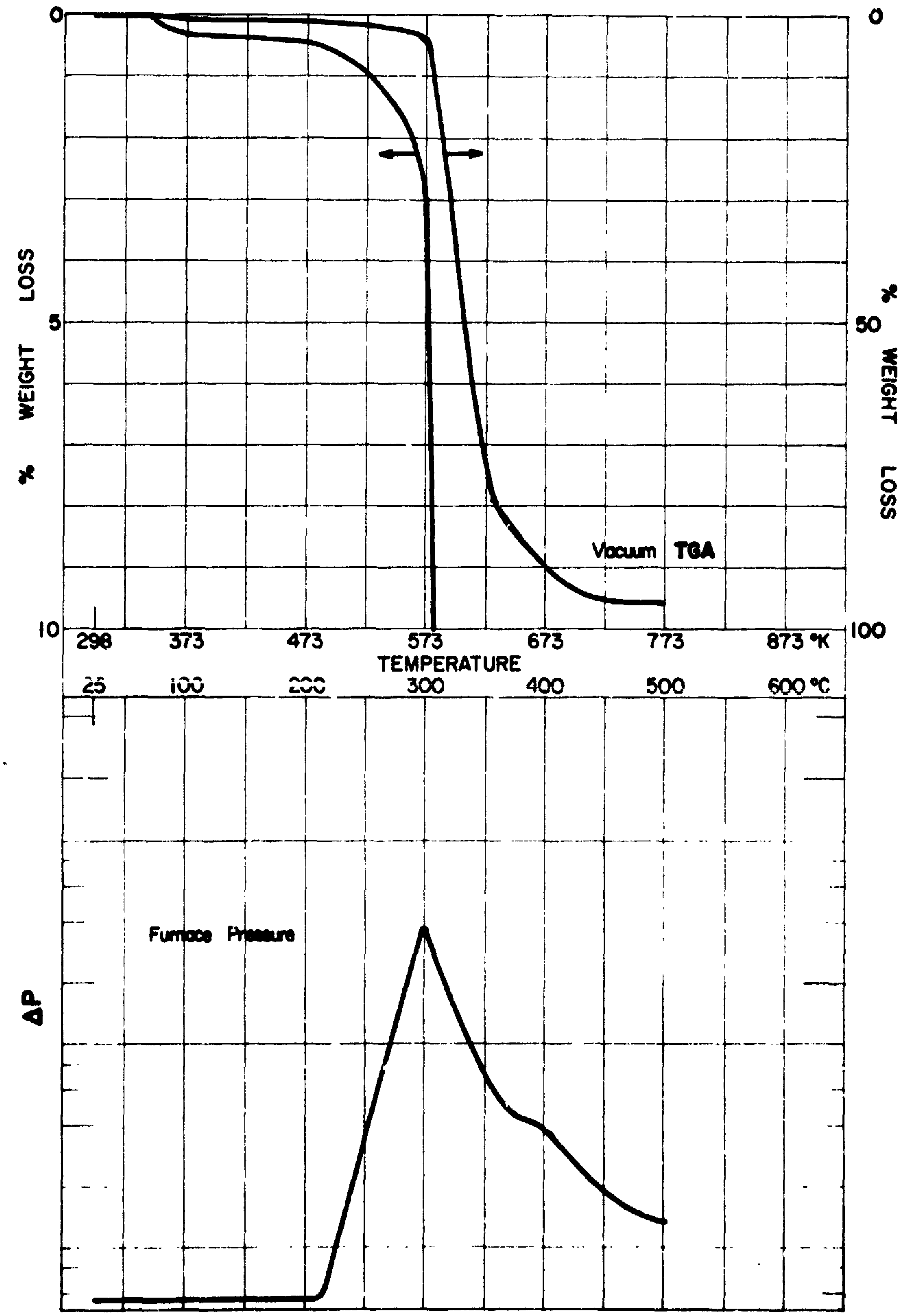
Over the range:

a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^\circ K}\right) \quad min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	8.4×10^{11}	
100°C (373°K)	1.9×10^{8}	
150°C (423°K)	2.9×10^{5}	


0
5
10
% WEIGHT LOSS
0
50
100
% WEIGHT LOSS
Vacuum TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
Furnace Pressure
ΔP

Pu2

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	225	300	375	500		
14	827	926	2175	1310	1099		
15	181	273	2873	875	523		
16	2350	[illegible]	4266	2961	2579		
17	6039	4933	5752	5654	6006		
18	17828	13932	14773	15191	16169		
19	88	85	85	147	89		
20	69	62	91	94	99		
21							
22			59				
23							
24		56	540	126	51		
25		120	1485	409	136		
26	99	622	11192	2468	762		
27		834	18129	4596	1588		
28	6526	8518	35786	14896	10717		
29	138	271	4303	4983	1776		
30	825	877	2400	2272	1484		
31			473	1237	345		
32	2248	2100	2005	2232	2559		
33			62				
34			48				
35							
36				103	40		
37		116	6685	686	158		
38		178	13683	1166	307		
39		418	21876	3842	1114		
40	629	748	9854	1830	1109		
41	42	194	7448	3511	986		
42	41	149	4055	1355	336		
43							
44	559	2116	9773	5538	1474		
45		47	1228	340	127		
46			644	102			
47				77			
48							
49					88		
50		262		1847	374		
51		338	25728	1658	399		
52		220	20716	1227	296		
53		115	6443	1244	367		
54		59	4677				
55		57	1157	4087	714		
56		40	1301	1692			
57			759	2284	542		
58				[illegible]	[illegible]		
59			2708	178	51		
60		46		148			
61				234	59		
62							
63		237	13882	584	138		
64		200	15163	628	148		
65		188	12746	794	211		
66		76	7362	565			
67		79	3862	592	213		
68			1392	408	125		
69			477	301	116		
70			279	334	107		
71			173	422	116		
72					40		
73					57		
74				470	80		
75							
76		162	15702	1291	192		
77		163	12439	727	190		
78		108	6496	428	124		
79		64	2509	222	107		
80		42	2133	201	71		
81			429	99	45		
82			110				
83			145		162		
84			230	1309	211		
85							
86				476	103		
87		41	2281	121			
88		47	1945	84			
89							
90		179					
91		205	16965	600	164		
92		87	6934	481	126		

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, ^{o}C

m/e	25	225	300	375	500		
93		61	5693	470	119		
94			1159	150	60		
95			168	52			
96			56	43			
97			74	49			
98				66			
99			495				
100			425				
101		40					
102					52		
103		97	6464		93		
104		59	4021	935	115		
105		51			129		
106		48	6233	510	144		
107			683	73			
108			71				
109							
110							
111							
112				42			
113							
114							
115							
116		52					
117							
118		215	16158	528			
119		113	12438	654	154		
120		53	5219	368	115		
121			1600	214	84		
122			901	156	61		
123			94				
124							
125							
126							
127							
128							
129			458	45			
130							
131							
132		80	8952	278	76		
133				56			
134			113				
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145		226	30431	774	138		
146		166	18119				
147		117	19086	1641	307		
148		123					
149							
150							
151							
152							
153							
154							
155							
156							
157			69				
158			75				
159							
160			58				
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

MASS NUMBER AND RELATIVE PEAK INTENSITY (Conc)

TEMPERATURE, °C

m/e	25	225	300	375	500		
172							
173							
174		317	3302[illegible]	784	153		
175		41					
176							
177							
178							
179							
180							
181							
182							
183							
184							
185							
186							
187							
188							
189							
190							
191							
192							
193							
194							
195							
196							
197							
198							
199							
200							
201							
202							
203							
204							
205							
206							
207							
208							
209							
210							
211							
212							
213							
214							
215							
216							
217							
218							
219							
220							
221							
222							
223							
224							
225							
226							
227							
228							
229							
230							
231							
232							
233							
234							
235							
236							
237							
238							
239							
240							
241							
242							
243							
244							
245							
246							
247							
248							
249							
250							

Eccofoam FPH/12-6H

Chemical Characterization Summary

Mix ratio: 100 pbw of resin to 75 pbw of catalyst
Cure: 24 hr at room temperature

1. Isothermal Weight loss in Nitrogen: 0.51%

2. Steady-State Vacuum Condensible Degassing Rate: 5.643×10^{-5} %/day

3. TGA Conditioning:

TCA Vacuum: 100 hr at 125°C (398°K) in N_2 atmosphere
Nitrogen: 24 hr min at 23°C (296°K) and 45% RH

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 200°C-350°C (473°K-623°K)

a_o = 79% of initial weight

$$k = 1.7 \times 10^{7} \quad \exp\left(\frac{-20800}{1.98\ T^{\circ}K}\right) \quad \min^{-1}$$

In Nitrogen:

Over the range: 170°C-385°C (443°K-658°K)

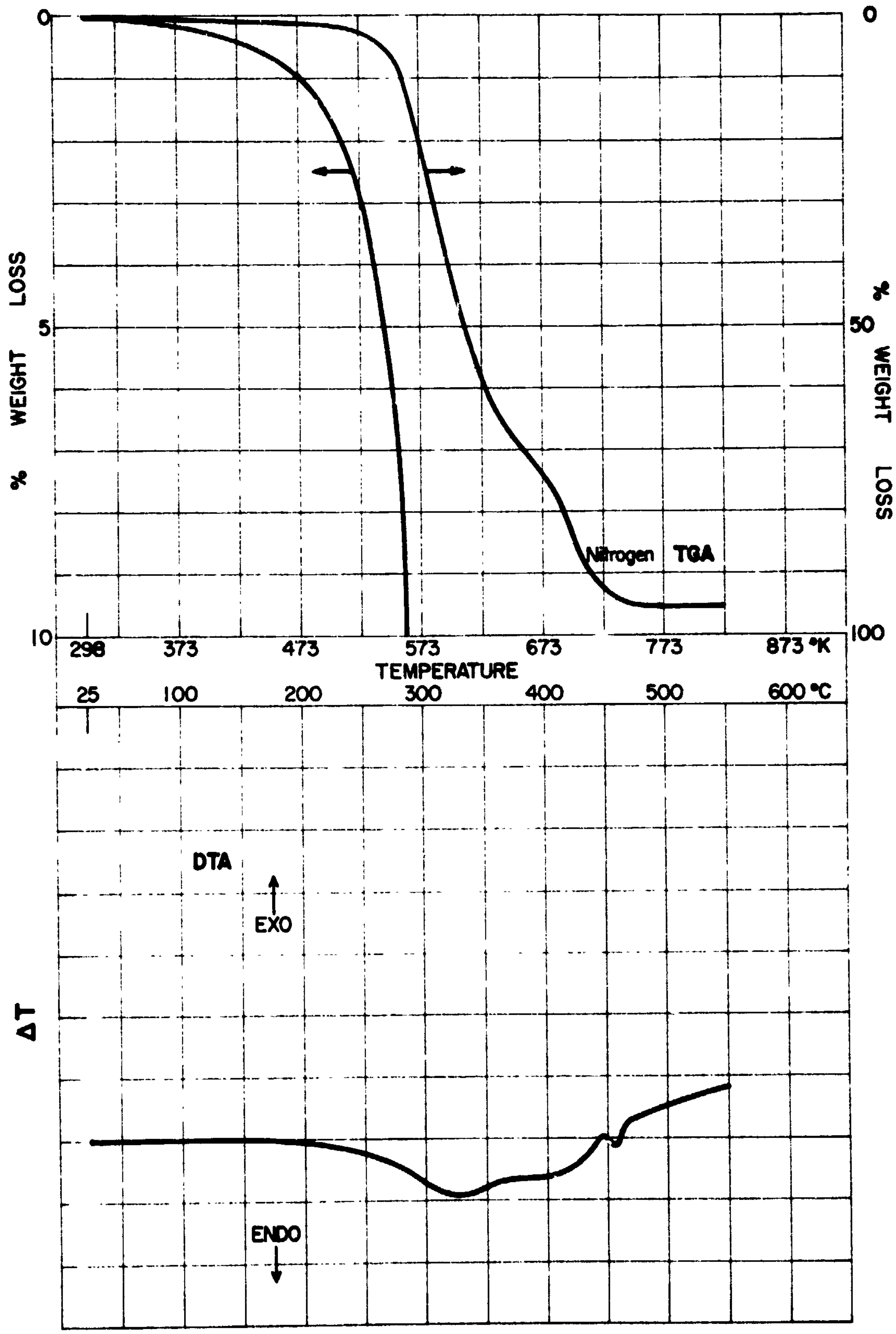
a_o = 62% of initial weight

$$k = 7 \times 10^{9} \quad \exp\left(\frac{-27900}{1.98\ T^{\circ}K}\right) \quad \min^{-1}$$

Time to 1% Weight Loss at Temperature T

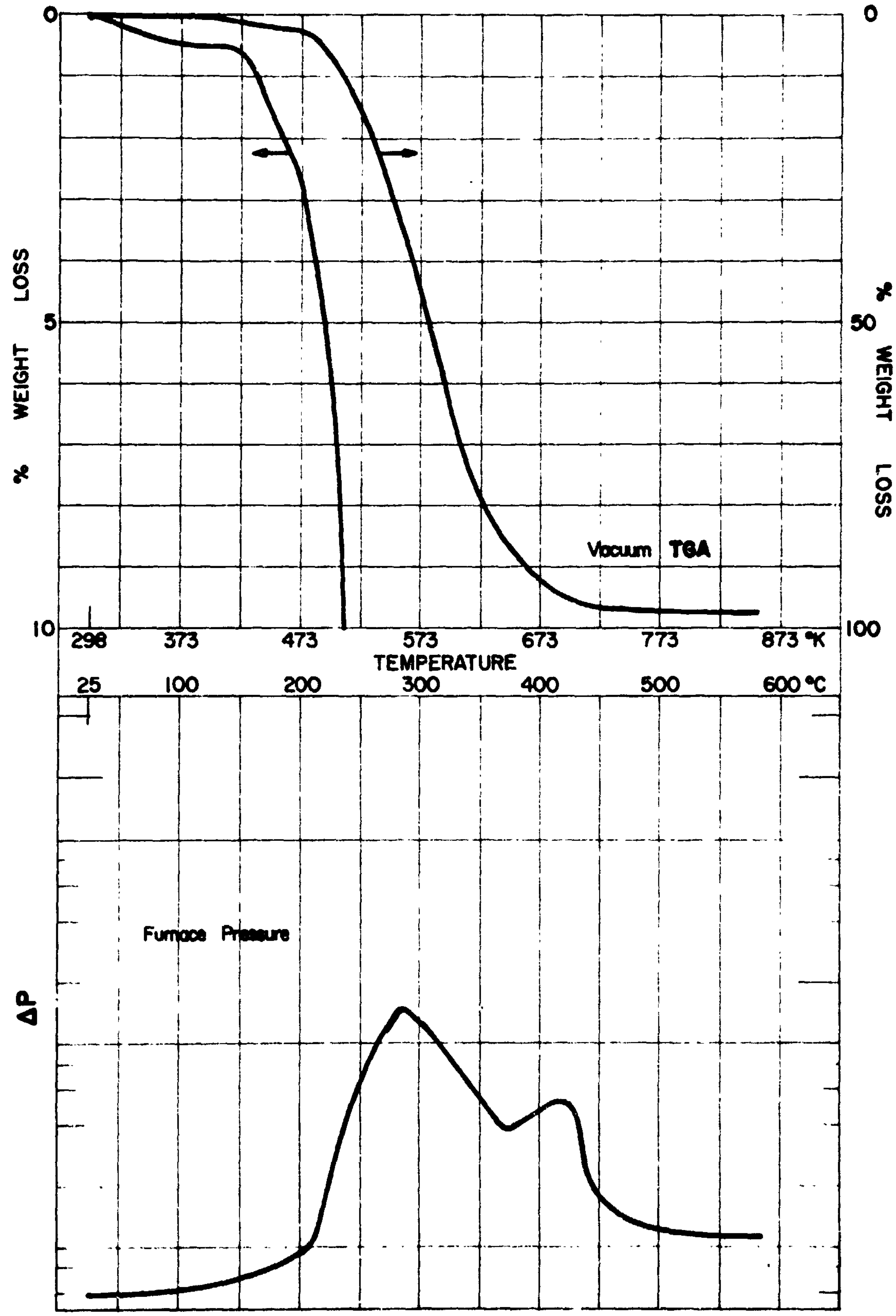
Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	4.8×10^{6}	7.7×10^{8}
100°C (373°K)	6.1×10^{4}	2.2×10^{6}
150°C (423°K)	2.1×10^{3}	2.5×10^{4}

Eccofoam FPH/12-6H



Pu 7

Eccofoam FPH/12-6H



Pu8

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	100	225	325	400	500	
14	685	699	948	1333	1169	932	
15	117	151	519	1136	938	627	
16	3138	3128	3786	4187	3912	3279	
17	13246	12671	11138	10956	10812	10407	
18	43959	41235	35016	33242	33126	31353	
19			41	51	59	48	
20	67	74	66	97	103	92	
21							
22							
23							
24			97	174	66		
25			412	726	385	109	
26	47	87	2971	5079	2923	930	
27	162	220	4614	8337	4877	1814	
28	9574	9768	17562	23508	18804	12069	
29	52	66	466	2850	5096	2408	
30	738	814	985	2006	2411	1695	
31				182	561	194	
32	2739	2682	2417	2460	2327	2344	
33							
34							
35							
36				67	40		
37			386	1158	206	63	
38			932	2555	544	135	
39			1484	4827	2992	924	
40	965	1003	1710	3068	1882	1329	
41			548	1957	3375	983	
42			300	926	1247	296	
43			352	1097	1125	553	
44	327	354	6035	6935	6046	1248	
45			152	200	156	63	
46				66			
47							
48				49			
49			116	365	95		
50			1120	3059	564	122	
51			1634	4411	585	108	
52			1146	3156	305	67	
53			269	1072	649	176	
54			132	529	200	55	
55				814	4492	731	
56			48	361	1422	208	
57				275	1094	342	
58				107	108	70	
59			91	478	40		
60				105			
61			48	170			
62			131	546			
63			533	1637	77		
64			651	1908	64		
65			537	1448	123	41	
66			185	739	82		
67			98	410	178	69	
68				104	90	40	
69				60	74	52	
70				40	85		
71				48	82		
72				53			
73				65			
74			71	220			
75			150	501			
76			450	1393			
77			404	1224	79		
78			133	517			
79			62	124	41		
80				75			
81							
82							
83					78	42	
84				136	894	119	
85							
86				43	73		
87			48	121			
88				50			
89				60			
90			88	417			
91			410	1045	45		
92			71	194			

Eccofoam FPH/12-6H

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	100	225	325	400	500	
93			106	155			
94							
95							
96							
97							
98							
99							
100							
101							
102				60			
103			60	99			
104				41			
105							
106				64			
107							
108							
109							
110							
111							
112							
113							
114							
115							
116							
117							
118				53			
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Table 1 Compressive Strength (ASTM D1621)*

Exposure	Average		High		Low		Samples Tested
	psi	Pa $\times 10^{-5}$	psi	Pa $\times 10^{-5}$	psi	Pa $\times 10^{-5}$	
Baseline (1)	113	7.79	121	8.34	93	6.41	5
Heat compatibility (2)	122	8.41	141	9.72	83	5.72	5
Heat Compatibility (2) plus 30 days thermal vacuum (3)	126	8.69	152	10.48	103	7.10	5

*Head speed 0.20 inches/minute

(1) Mixed in the ratio of 50 pbw resin to 37.5 pbw catalyst and cured for 24 hours at room temperature

(2) 570 hours at 275°F (408°K) in N_2 atmosphere

(3) Tested at 1×10^{-5} Torr after exposure for the specified time at 150°F (338°K) and 10^{-6} Torr

Pull

Table 2 Dielectric Constant at 1 MHz (ASTM D1673)

Exposure	Average	High	Low	Samples Tested
Baseline (1)	1.08	1.08	1.07	5
Heat compatibility (2)	1.08	1.09	1.07	5
Heat compatibility (2) plus 30 days thermal vacuum (3)	1.08	1.08	1.08	5

(1) Mixed in the ratio of 50 pbw resin to 37.5 pbw catalyst and cured 24 hours at room temperature

(2) 570 hours at 275°F (408°K) in N_2 atmosphere

(3) Tested at 10^{-5} Torr after exposure for the specified time at 150°F (338°K) and 10^{-6} Torr.

Chemical Characterization Summary

Mix ratio: 100 pbw of 113 to 73 pbw of C113-300
Cure: 48 hr at $225^\circ F$ ($394^\circ K$)

1. Isothermal Weight loss in Nitrogen: 0.75%

2. Steady-State Vacuum Condensible Degassing Rate: 3.8×10^{-4} %/day

3. TGA Conditioning:

TGA Vacuum: 24 hr at $23^\circ C$ ($296^\circ K$) and 45% RH
Nitrogen: 24 hr at $23^\circ C$ ($296^\circ K$) and 45% RH

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: $25^\circ C-285^\circ C$ ($298^\circ K-558^\circ K$)

a_o = 0.9% of initial weight

$$k = 4.3 \times 10^{7} \exp\left(\frac{-22800}{1.98\ T^\circ K}\right) \text{min}^{-1}$$

In Nitrogen:

Over the range: $25^\circ C-350^\circ C$ ($298^\circ K-623^\circ K$)

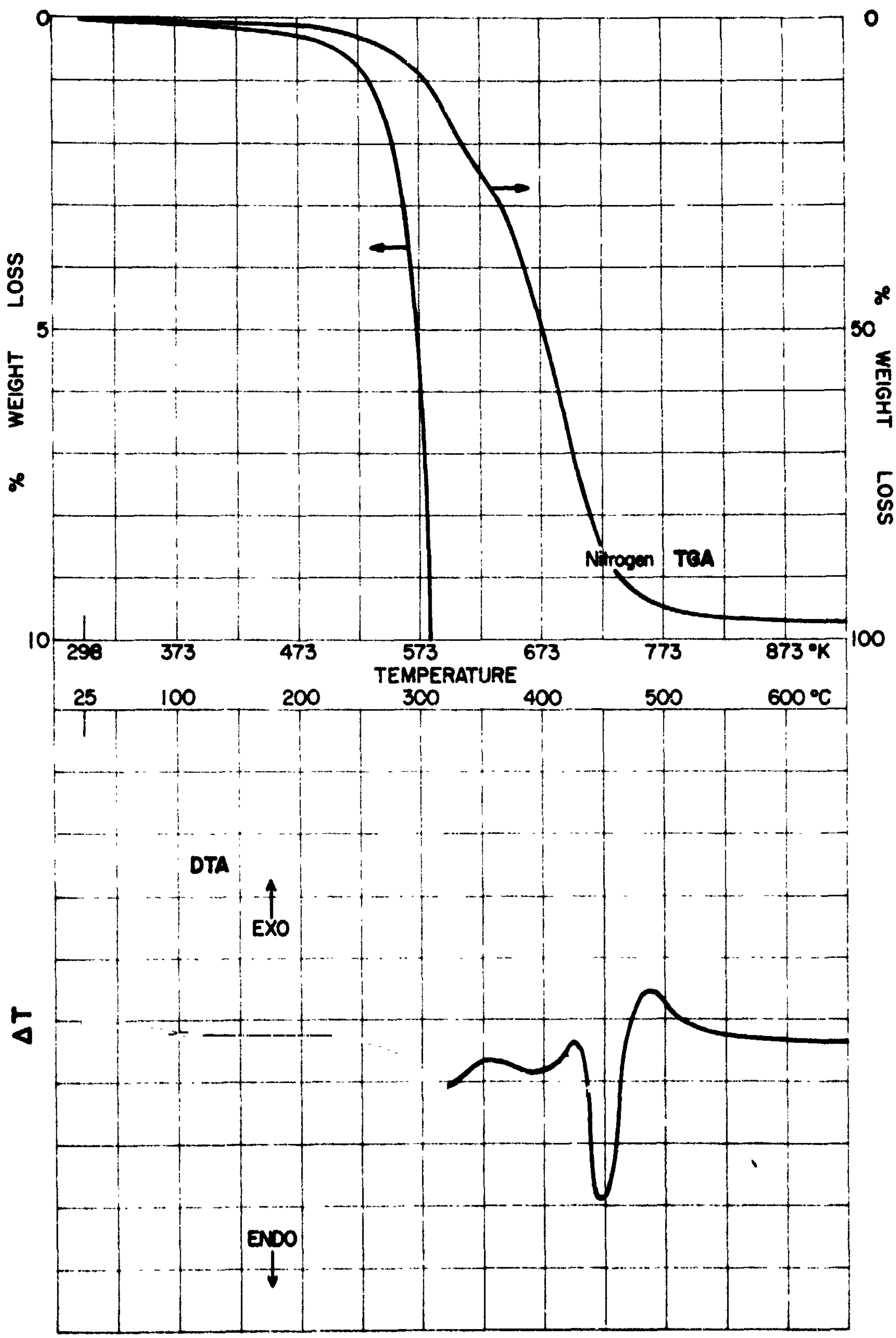
a_o = 19.8% of initial weight

$$k = 1.4 \times 10^{16} \exp\left(\frac{-37400}{1.98\ T^\circ K}\right) \text{min}^{-1}$$

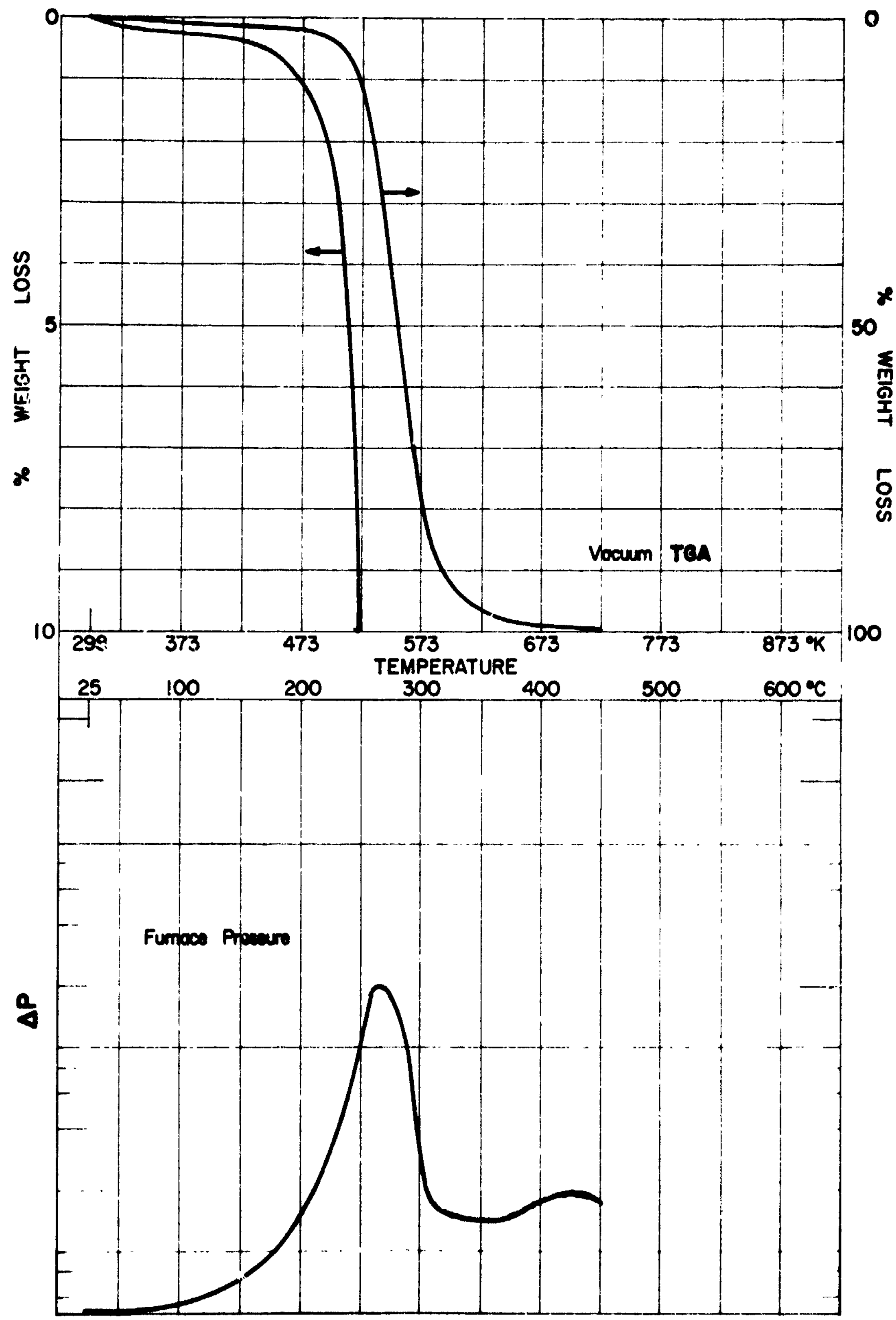
Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
$50^\circ C$ ($323^\circ K$)	4.4×10^{7}	1.1×10^{9}
$100^\circ C$ ($373^\circ K$)	3.7×10^{5}	4.4×10^{5}
$150^\circ C$ ($423^\circ K$)	9×10^{3}	1×10^{3}

Solithane 113/C113-300



Pu14


0
5
10
% WEIGHT LOSS
0
50
100
% WEIGHT LOSS
Vacuum TGA
298 373 473 573 673 773 873 °K
TEMPERATURE
25 100 200 300 400 500 600 °C
Furnace Pressure
ΔP

Solithane 113/C113-300

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	125	200	275	350	525	
14	1442	1406	1424	4630	1568	1834	
15	196	213	284	6451	568	1011	
16	2456	2232	2562	10860	2517	2769	
17	10735	9368	8680	11017		9472	
18	39347	34228	31699	35839	27659	33609	
19							
20	98	87	79	237	80	97	
21							
22				344			
23							
24							
25							
26	63	144	754			2860	
27	143						
28	23675	22780	24860	100684	25910	26097	
29	138	175	320	7040	1179	2581	
30	48		54	2576	138	185	
31							
32	5810	5446	5274	5286	4495	4538	
33							
34							
35							
36							
37			67		189	96	
38			158				
39				38034	2078	1877	
40	1590	1588	1826		2014	1942	
41			81	13848	912	1787	
42			56	8536			
43			72				
44	219	416	3565	62193	3901	3195	
45				4302	62	89	
46							
47							
48							
49			109				
50			205		1177	177	
51			453	42014	1292	158	
52			174		829	88	
53					214	153	
54					85		
55				2182	318	1308	
56				1797	226	751	
57				748	45	115	
58					43		
59				7656	83		
60				3934	48		
61					40		
62			45				
63			112	20094	412		
64			157	20999	490		
65			73	18086	473	66	
66					219	58	
67					112	234	
68				1703		67	
69							
70				1030		88	
71							
72							
73							
74					58		
75			53		78		
76			94	18657	354		
77			80	16738	389	101	
78			40	8234	128		
79				2751		70	
80				2491			
81				475		45	
82							
83							
84				42			
85							
86							
87				3065			
88							
89							
90							
91			207	20154	383		
92				8088	118		

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	125	200	275	350	525	
93				6931	100		
94				1040			
95							
96							
97							
98							
99				132			
100				95			
101				50			
102							
103				7599	68		
104				4261	50		
105						40	
106				9758	204		
107				63[illegible]			
108							
109							
110							
111							
112							
113							
114							
115							
116							
117							
118			176	14152	180		
119			47	14075	273		
120				7380			
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Table 1 Lap Shear* (ASTM D1002)

Exposure	Average		High		Low		Samples Tested
	psi	Pa $\times 10^{-6}$	psi	Pa $\times 10^{-6}$	psi	Pa $\times 10^{-6}$	
Baseline	305	2.10	392	2.70	242	1.67	5
Heat Compatibility (1)	271	1.87	340	2.34	206	1.42	5
1 Month Thermal Vacuum (2)	342	2.36	416	2.87	252	1.74	5
3 Month Thermal Vacuum (2)	315	2.17	536	3.70	100	6.89	5

*Cured 1 hour at 275°F (408°K)

(1) 575 hours at 275°F(408°K) in an N_2 atmosphere

(2) Tested at a pressure of 1×10^{-5} Torr after the specified exposure time at 150°F (338°K) at 1×10^{-6} Torr preceded by heat compatibility

Table 2 Hardness* (ASTM D2240)

Exposure	High	Low	Average	Samples Tested
Baseline	57 Shore A	55 Shore A	56 Shore A	5
Heat Compatibility(1)	59 Shore A	56 Shore A	57 Shore A	5

Table 3 Volume Resistivity* (ASTM D257) @ 500 VDC

Baseline	1.25×10^{15}	1.0×10^{14}	4.6×10^{14}	5

Table 4 Dielectric Constant* (ASTM D150) @ 1 MHz

Baseline	3.87	2.63	3.08	5

Table 5 Insulation Resistance * (ASTM D257) @ 100 VDC

Baseline	9.0×10^{15}	4.8×10^{15}	6.1×10^{15}	5
Heat Compatibility(1)	1.1×10^{13}	5.1×10^{12}	7.4×10^{12}	5
Heat Compatibility Plus 48 hrs at 50% R.H.	1.8×10^{13}	8.1×10^{12}	1.3×10^{13}	5
1 Month Thermal Vacuum (2)	2.3×10^{15}	1.4×10^{15}	1.9×10^{15}	5

*Cured 1 hour at 275°F (408°K)

(1) Heat Compatibility - 575 hours at 275°F(408°K) in N_2 atmosphere

(2) Thermal Vacuum - Tested at 1×10^{-5} Torr after the specified exposure time at 150°F (338°K) and 1×10^{-6} Torr preceded by heat compatibility

Table 6. Dielectric Strength* (ASTM D149)

Exposure	Thickness		Average		High		Low		Samples Tested
	mil	m	Volts/m $\times 10^{-7}$	Volts/mil	Volts/m $\times 10^{-7}$	Volts/mil	Volts/m $\times 10^{-7}$	Volts/mil	
Baseline	7	1.78×10^{-4}	7.3	1862	7.4	1867	7.3	1857	2

*Cured 1 hour at 275°F (408°K)

Chemical Characterization Summary

Mix ratio: As received sheet stock
Cure: As received. Postcured 24 hr at 350°F (450°K) at $1x10^{-3}$ Torr

1. Isothermal Weight loss in Nitrogen: 0.02%

2. Steady-State Vacuum Condensible Degassing Rate: $2.2x10^{-4}$ %/day

3. TGA Conditioning:

   TGA Vacuum: 100 hr at 125°C (398°K) in N_2 atmosphere
   Nitrogen: 24 hr at 23°C (296°K) and 45% RH

4. Activation Energy of Decomposition:

   In Vacuum:

   Over the range: 330°C-720°C (603°K-993°K)

   a_o = 19% of initial weight

   $$k = 2x10^5 \quad \exp\left(\frac{-24000}{1.98\ T^{o}K}\right) \quad min^{-1}$$

   In Nitrogen:

   Over the range: 300°C-660°C (603°K-933°K)

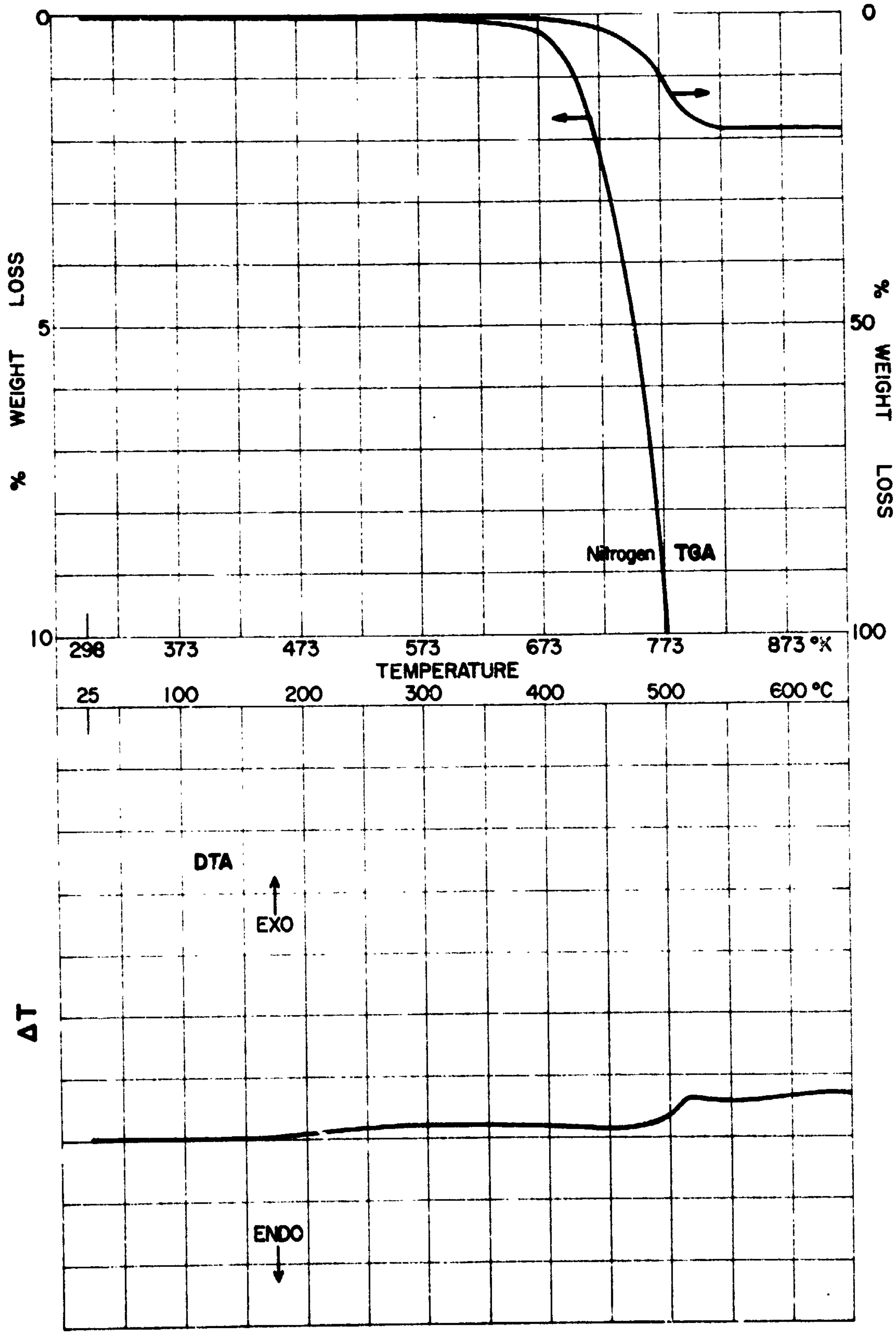
   a_o = 19% of initial weight

   $$k = 1.5x10^{10} \exp\left(\frac{-38200}{1.98\ T^{o}K}\right) \quad min^{-1}$$

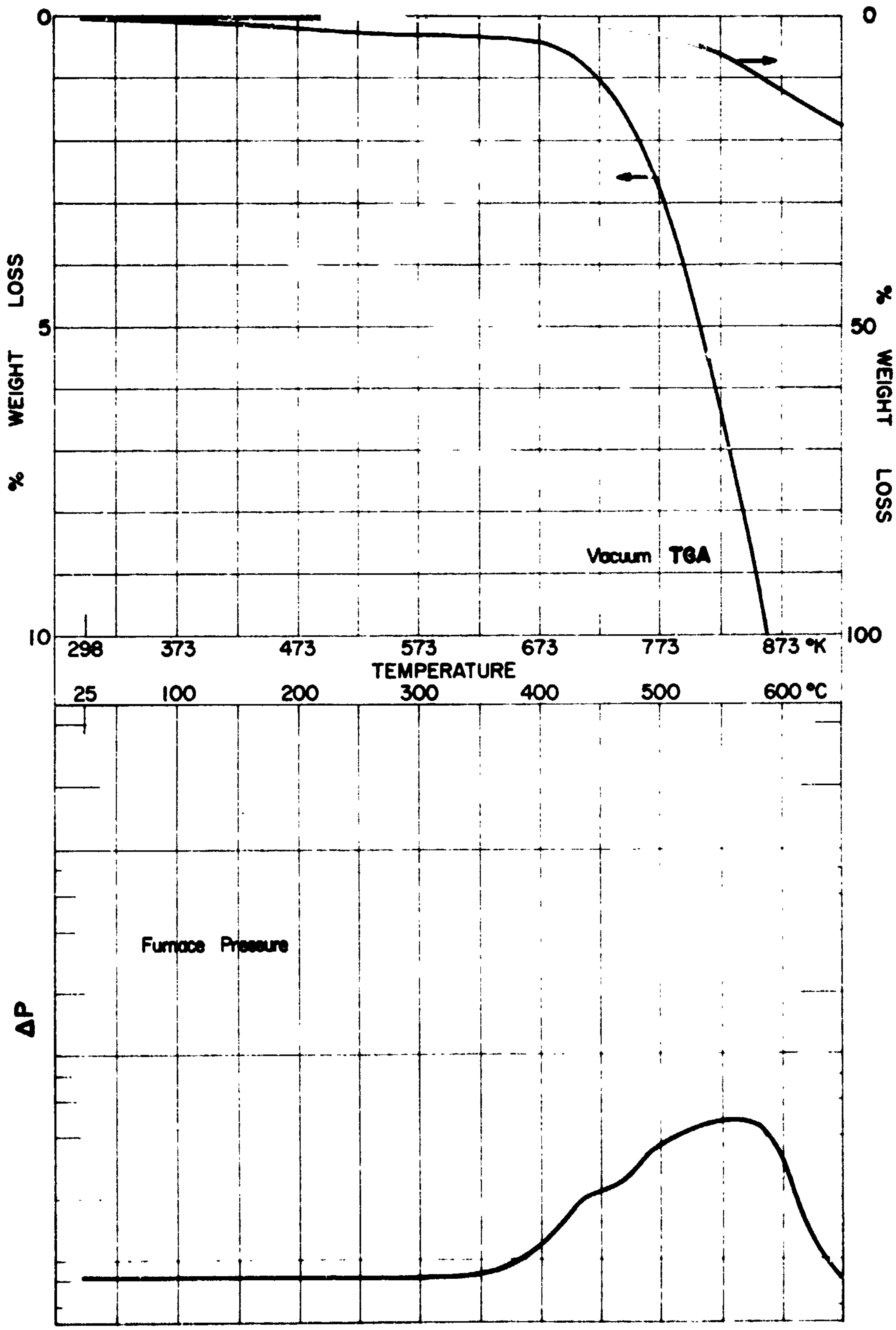
Time to 1% Weight Loss at Temperature T

Temp	Time (Sec) In Vac	Time (Sec) In Nitrogen
50°C (323°K)	$6.0x10^{10}$	$5.5x10^{13}$
100°C (373°K)	$4.0x10^{8}$	$1.2x10^{10}$
150°C (423°K)	$8.2x10^{6}$	$2.5x10^{7}$

Cho-Seal 1224



S2



0
5
10
% WEIGHT LOSS
0
50
100
% WEIGHT LOSS
Vacuum TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
Furnace Pressure
ΔP

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	150	350	425	500	600	
14	650	653	657	710	968	1130	
15		186	198	389	1195	1635	
16	2957	2787	2704	2606	2736	2893	
17	11078	9389	8242	7744	6880	6645	
18	35697	29180	24885	22677	20236	18964	
19	45	54	51	42	55	81	
20	94	86	82	102	70	78	
21							
22							
23							
24						44	
25				44	71	113	
26	44	65	66	166	570	728	
27				250	405	502	
28	8126	7844	7814	7765	8019	8303	
29	76	88	92	127	226	275	
30	737	760	759	745	701	671	
31							
32	2429	2324	2180	2016	1850	1783	
33							
34							
35							
36							
37							
38							
39				52	75	96	
40	1189	1177	1220	1154	1096	1122	
41				51	60	52	
42						45	
43			41	59	58	87	
44	473	496	495	462	414	394	
45					66	175	
46							
47							
48							
49							
50							
51					43	51	
52					41	54	
53						48	
54							
55							
56							
57							
58							
59							
60					50	118	
61						53	
62							
63							
64							
65							
66							
67							
68							
69							
70							
71							
72							
73							
74					268	834	
75						67	
76					48	99	
77							
78						56	
79					81	130	
80							
81							
82						50	
83							
84							
85							
86							
87							
88							
89				45			
90						56	
91							
92						47	

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	150	350	425	500	600	
93							
94							
95							
96							
97				49	160	353	
98							
99							
100							
101							
102							
103							
104						44	
105							
106							
107							
108							
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Table 1 Tensile Strength and Elongation* (ASTM D412-68)

Exposure	Average		High		Low		Samples Tested
	psi	Pa $\times 10^{-6}$	psi	Pa $\times 10^{-6}$	psi	Pa $\times 10^{-6}$	
Baseline	312 @ 498%	2.15 @ 498%	348 @ 560%	2.40 @ 498%	300 @ 440%	2.07 @ 498%	5
Heat Compatibility	300 @ 291%	2.07 @ 291%	342 @ 320%	2.36 @ 320%	288 @ 270%	1.99 @ 498%	5

*Postcured 24 hours at 350°F(450°K) at 1×10^{-3} Torr

(1) Heat compatibility - 379 hours at 275°F(408°K) in an N_2 atmosphere

Table 2 Solvent Resistance* (ASTM D471-66)

Solvent	Exposure	Hardness, Shore A (1)		Samples Tested
		Before	After	
FreonTMC	Baseline	60	55	1
	Heat Compatibility (2)	63	55	1
Trichloro-ethane 1-1-1	Baseline	59	55	1
	Heat Compatibility (2)	62	55	1
Methyl Ethyl Ketone	Baseline	58	55	1
	Heat Compatibility (2)	62	55	1

*Postcured for 24 hours at 350°F(450°K) at $1x10^{-3}$ Torr

(1) One hour after removal from the solvent

(2) Solvent exposure after 379 hours at 275°F(408°K) in N_2 atmosphere

Cho-Seal 1224

Table 3 Hardness* (Shore A)(FTMS 601 Method 3021)

Exposure	Average	High	Low	Samples Tested
Baseline	60	63	59	5
Heat Compatibility(1)	59	60	57	5

Table 4 Compression Set* (ASTM D395-61)

Baseline	6.20%	8.78%	2.11%	3
Heat Compatibility(1)	13.14%	13.80%	11.84%	3
Heat Compatibility Plus Thermal Vacuum (1)(2)	10.39%	10.77%	9.80%	3

*Postcured 24 hours at $350^{o}F(450^{o}K)$ at a pressure of $1x10^{-3}$ Torr

(1) Heat compatibility - 379 hours at $275^{o}F(408^{o}K)$ in an N_2 atmosphere

(2) Tested at a pressure of $1x10^{-5}$ Torr after 37 days at $150^{o}F(338^{o}K)$ at a pressure of $1x10^{-6}$ Torr

Table 5. Volume Resistivity* (ASTM D257)

Exposure	High	Low	Average	Samples Tested
Baseline	$9.8x10^{-4}$	$3.0x10^{-4}$	$6.2x10^{-4}$	3
Heat Compatibility(1)	$8.0x10^{-4}$	$4.9x10^{-4}$	$5.9x10^{-4}$	3
Thermal Vacuum(2)	$4.9x10^{-4}$	$4.5x10^{-4}$	$4.8x10^{-4}$	3

*Postcured at 24 hrs at 350°F (450°K) at $1x10^{-3}$ torr

(1) Heat compatibility - 379 hrs at 275°F (408°K) in N_2 atmosphere

(2) Thermal Vacuum - tested at $1x10^{-5}$ torr after 37 days at 150°F (338°K) and $1x10^{-6}$ torr

Chemical Characterization Summary

Mix ratio: As received
Cure: As received

1. Isothermal Weight loss in Nitrogen: 0.09%

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 25°C-550°C (298°K-823°K)

a_o = 22% of initial weight

$$k = 5 \quad \exp\left(\frac{-\ 9310}{1.98\ T^{o}K}\right) \quad min^{-1}$$

In Nitrogen:

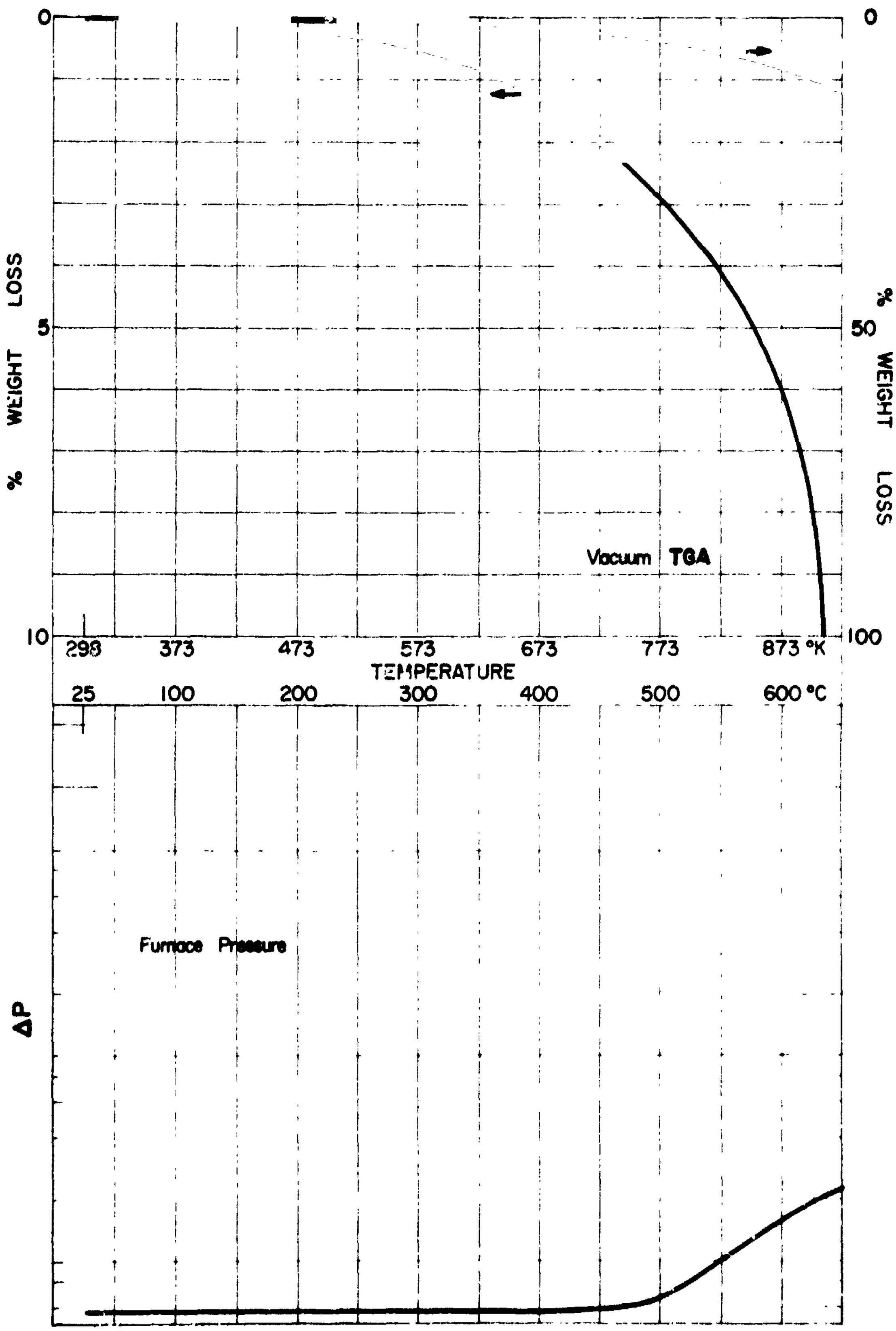
Over the range:

a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \quad min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	2.6×10^5	
100°C (373°K)	3.6×10^4	
150°C (423°K)	8.0×10^3	


% WEIGHT LOSS
% WEIGHT LOSS
0
5
10
0
50
100
Vacuum TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
Furnace Pressure
ΔP

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	300	600	650	700	750	
14	2571	2606	5767	9012	7925	5284	
15	1082	1449	13178	25594	23008	12458	
16	7391	7767	15889	27034	27659	18662	
17	26069	23544	20862	20361	20713	20723	
18	85580	75723	64983	62276	62681	64076	
19	722	730	987	1102	1056	1256	
20	639	627	555	643	646	449	
21							
22							
23							
24				164	704		
25			656	1313		221	
26	365	564	4457	7334	4677	2571	
27	684	757	3500	6000	3801	2298	
28	35364	35373	43521	49759	43863	42829	
29	393	[illegible]	1485	2308	1964	951	
30	704	680	865	994	945	830	
31				201	451		
32	8528	7997	6914	6940	6888	7273	
33							
34							
35							
36							
37							
38				116			
39		43	571	1291	686	498	
40	5880	5887	6668	7263	7222	6984	
41		56	555	1209	752	569	
42			270	796	696	111	
43		81	351	1232	2217	209	
44	1332	1397	1466	1710	2138	2771	
45			886	2218	2843		
46							
47				70	47		
48							
49							
50							
51							
52							
53					129		
54							
55				64	245		
56							
57					53		
58				263	260		
59			467	2113	1878		
60							
61			231	543	48		
62							
63							
64				18	590	945	
65							
66			50	231	523	412	
67							
68					64	57	
69							
70							
71							
72							
73			3305	7764	11580	316	
74			104	568	719		
75			691	1328	1035		
76							
77							
78							
79							
80							
81			71	192			
82				54			
83							
84	46						
85							
86							
87			70	243			
88				40			
89			236	526			
90							
91							
92							

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	300	600	650	700	750	
93							
94							
95							
96			3065	3942	706		
97			92	603			
98							
99							
100							
101							
102							
103			258	573			
104							
105							
106							
107							
108							
109							
110							
111							
112							
113							
114							
115							
116				74			
117							
118							
119							
120			140	312			
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134			573	96[illegible]	66		
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: Single component
Cure: 7 days at room temp at 50% RH

1. Isothermal Weight loss in Nitrogen: 0.26%

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

   TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
   Nitrogen:

4. Activation Energy of Decomposition:

   In Vacuum:

   Over the range: 180°C-750°C (453°K-1023°K)

   a_o = 76% of initial weight

   $$k = 1.3\times10^{4} \exp\left(\frac{-21000}{1.98\ T^{o}K}\right) \min^{-1}$$

   In Nitrogen:

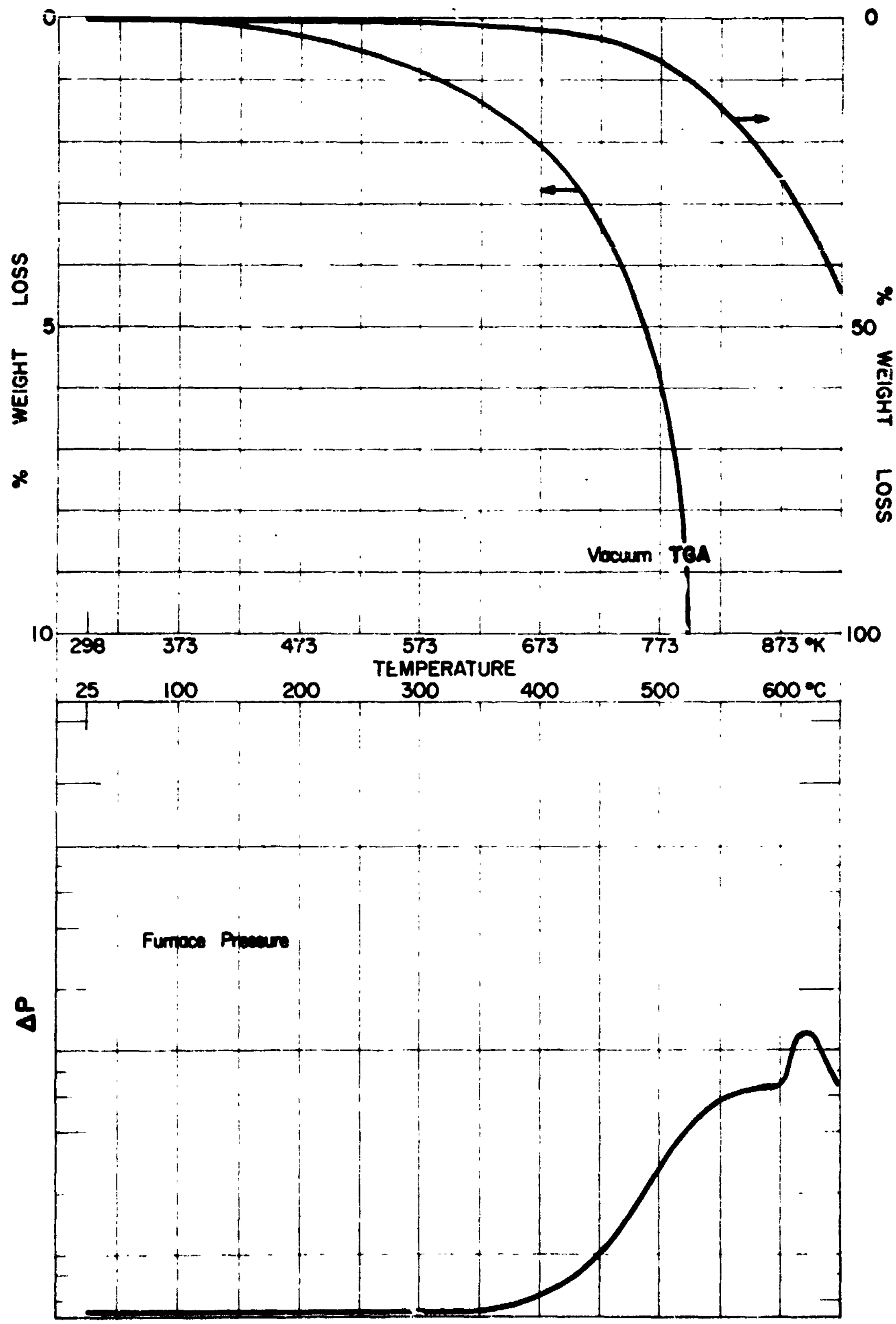
   Over the range:

   a_o = of initial weight

   $$k = \exp\left(\frac{-}{1.98\ T^{o}K}\right) \min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	8.9×10^{9}	
100°C (373°K)	1.1×10^{8}	
150°C (423°K)	3.6×10^{6}	


% WEIGHT LOSS
0
5
10
0
50
100
% WEIGHT LOSS
Vacuum TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
Furnace Pressure
ΔP

MASS NUMBER AND RELATIVE PEAK INTENSITY
TEMPERATURE, °C

m/e	25	250	400	600			
14	2925	2997	3460	13004			
15	1454	1613	3113	36133			
16	9715	9116	9361	19425			
17	30447	25661	22360	19366			
18	99448	79815	69982	56489			
19	386	356	393	365			
20	829	771	775	839			
21							
22							
23							
24			53	.62			
25	64	78	314	2667			
26	468	551	1128	11739			
27	965	947	1235	8226			
28	34935	34278	34096	54282			
29	575	690	1014	6880			
30	1181	1249	1335	1559			
31		155	172	717			
32	9310	8437	7716	6297			
33							
34							
35							
36				69			
37				194			
38			49	307			
39		147	200	1126			
40	7236	7094	7019	8260			
41	115	163	211	885			
42	99	134	183	744			
43	117	141	225	2556			
44	1818	1857	1760	2270			
45		40	198	8189			
46				493			
47			62	1487			
48				73			
49				68			
50				146			
51				180			
52				190			
53				159			
54				68			
55				329			
56				129			
57				304			
58				713			
59			53	5522			
60				590			
61			52	3978			
62				245			
63				225			
64	104	213	110				
65		99		121			
66	115	132	117	480			
67			49	176			
68				67			
69				89			
70				68			
71				572			
72				702			
73			162	24991			
74				3102			
75			378	7752			
76				541			
77				486			
78				152			
79				56			
80							
81				2461			
82	42		61	1471			
83				288			
84	215		203	324			
85				871			
86	70	54	43	749			
87				3			
88				1618			
89			50	4343			
90				489			
91				306			
92							

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	250	400	600			
93							
94							
95							
96			258	24051			
97			42				
98							
99				43			
100							
101				215			
102				308			
103			40	4993			
104				118[illegible]			
105				1474			
106				149			
107				168			
108							
109							
110				124			
111				223			
112				82			
113				74			
114							
115				2334			
116				322			
117				1088			
118				430			
119				3726			
120				420			
121				434			
122							
123							
124							
125				506			
126				122			
127							
128							
129	215	216	196	310			
130				54			
131	154	170	130	449			
132	193	177	190	616			
133			59	7770			
134	53	61	59	1153			
135				623			
136	45	46		107			
137							
138							
139							
140							
141							
142							
143							
144							
145				58			
146				57			
147				1004			
148				145			
149				325			
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161				171			
162							
163				50			
164				308			
165							
166				106			
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: 100 pbw of resin to 10 pbw of catalyst
Cure: 7 days at room temperature

1. Isothermal Weight loss in Nitrogen: 0.35%

2. Steady-State Vacuum Condensible Degassing Rate: 2.645×10^{-5} %/day

3. TGA Conditioning:

   TGA Vacuum: 100 hr at 125°C (325°K) in N_2 atmosphere
   Nitrogen: 24 hr at 23°C (296°K) and 45% RH

4. Activation Energy of Decomposition:

   In Vacuum: Not amenable to analysis

   Over the range:

   $a_o =$ of initial weight

   $$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \quad min^{-1}$$

   In Nitrogen:

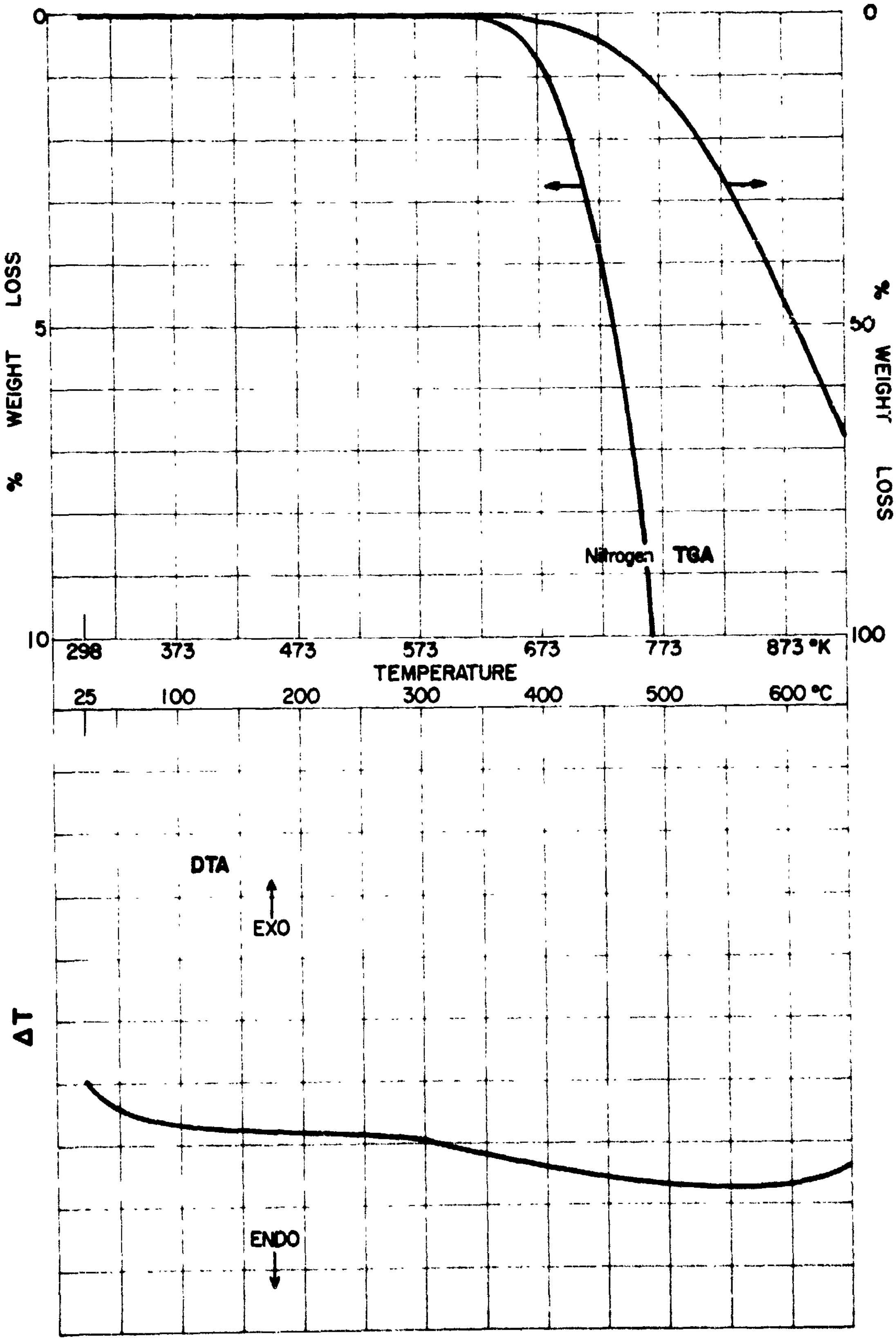
   Over the range: 350°C–750°C (623°K–1023°K)

   $a_o =$ 79% of initial weight

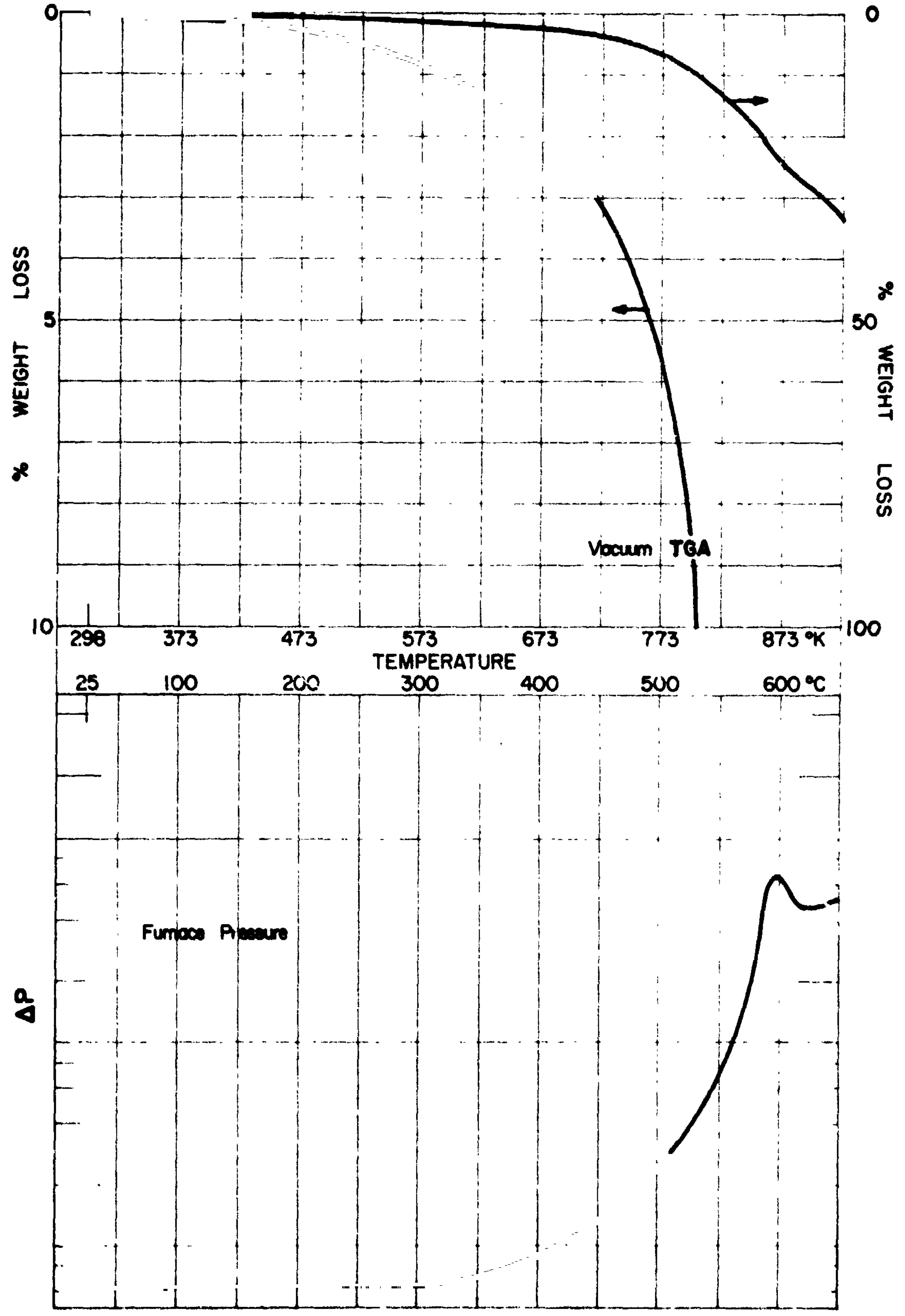
   $$k = 3.8\times10^{4} \exp\left(\frac{-21400}{1.98\ T^{o}K}\right) \quad min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)		5.5×10^{9}
100°C (373°K)		6.2×10^{7}
150°C (423°K)		1.9×10^{6}


0
5
10
% WEIGHT LOSS
0
50
100
% WEIGHT LOSS
Nitrogen TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
DTA
EXO
ENDO
ΔT

DC6-1106


% WEIGHT LOSS
0
5
10
% WEIGHT LOSS
0
50
100
Vacuum TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
Furnace Pressure
ΔP

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	200	400	500	650		
14	432	396	556	1168	1974		
15	94	104	307	2393	5421		
16	2328	2422	2687	3132	5218		
17	9958	9141	8320	7210	7528		
18	32696	29101	25751	21350	22017		
19					40		
20	42	43	41	45	50		
21							
22							
23							
24					55		
25				116	279		
26	47	62	232	899	1959		
27	100	124	469	576	1118		
28	8613	8487	8979	10315	13342		
29			259	290	546		
30	507	500	622	548	642		
31			241	61			
32	2290	2233	2162	1696	1845		
33							
34							
35							
36							
37							
38							
39			[illegible]	54	101		
40	686						
41			134	50	87		
42			41		53		
43			143	69	149		
44	160	215	237	207	283		
45			98	194	607		
46							
47					66		
48							
49							
50							
51							
52							
53							
54							
55							
56							
57							
58							
59				82	313		
60							
61				61	204		
62							
63							
64							
65							
66							
67							
68							
69							
70							
71							
72							
73				533	2970		
74				46	157		
75			[illegible]	191	431		
76							
77					30		
78							
79							
80							
81					73		
82					50		
83							
84							
85							
86							
87					83		
88							
89				4[illegible]	134		
90							
91							
92							

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	200	400	500	650		
93							
94							
95							
96				501	1644		
97					69		
98							
99							
100							
101							
102							
103					82		
104							
105							
106							
107							
108							
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: Single component
Cure: 48 hr at room temperature plus 48 hr at 255^{o}F (397^{o}K)

1. Isothermal Weight loss in Nitrogen: 0.18%

2. Steady-State Vacuum Condensible Degassing Rate: 7.33x10^{-5} %/day

3. TGA Conditioning:

TGA Vacuum: 100 hr at 125^{o}C (325^{o}K) in N_2 atmosphere
Nitrogen: 24 hr at 23^{o}C (296^{o}K) and 45% RH

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 25^{o}-650^{o}C(298^{o}K-923^{o}K)

a_o = 54% of initial weight

$$k = 5.2x10^{6} \quad \exp\left(\frac{-26700}{1.98\ T^{o}K}\right) \quad min^{-1}$$

In Nitrogen:

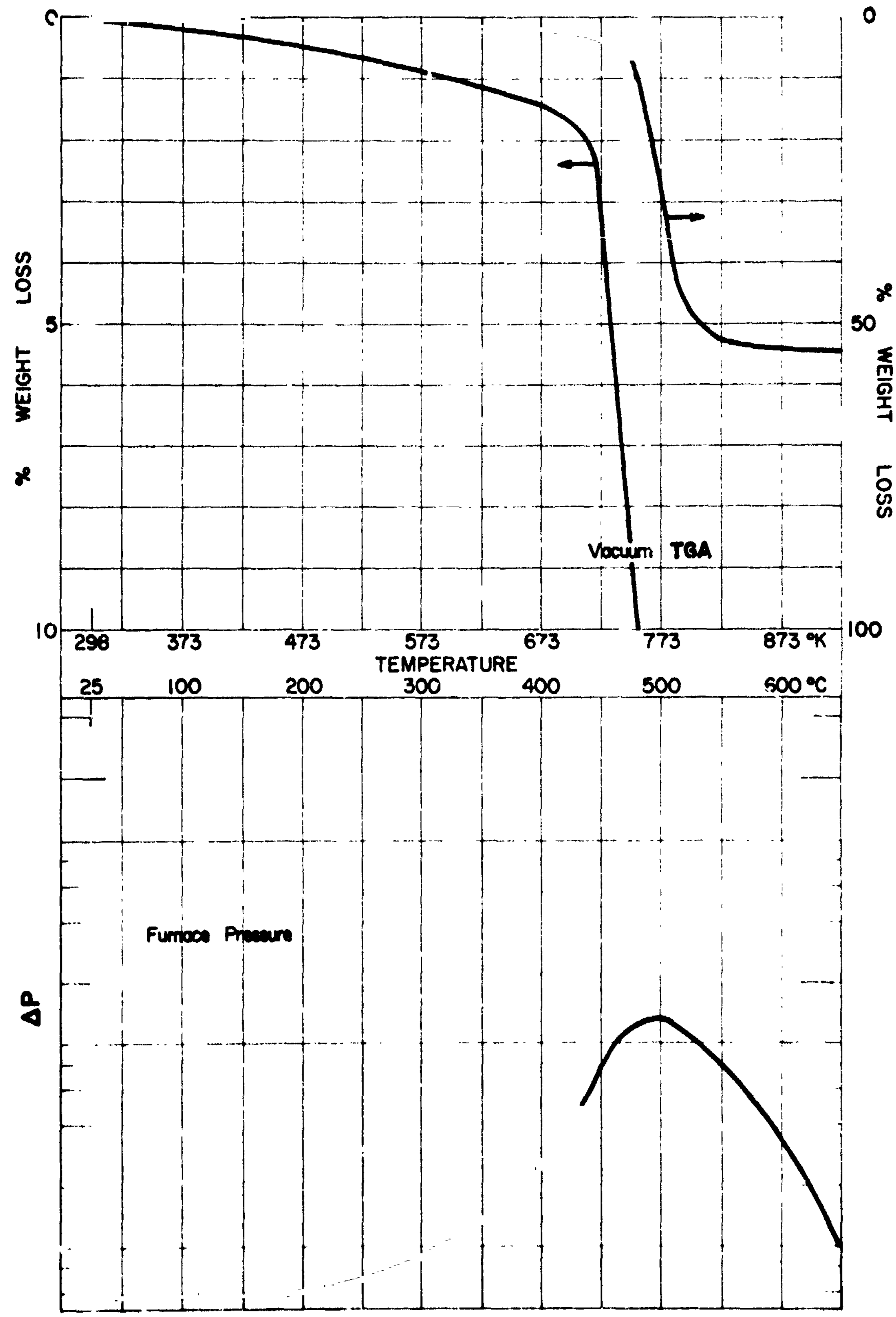
Over the range: 25^{o}C-650^{o}C (298^{o}K-923^{o}K)

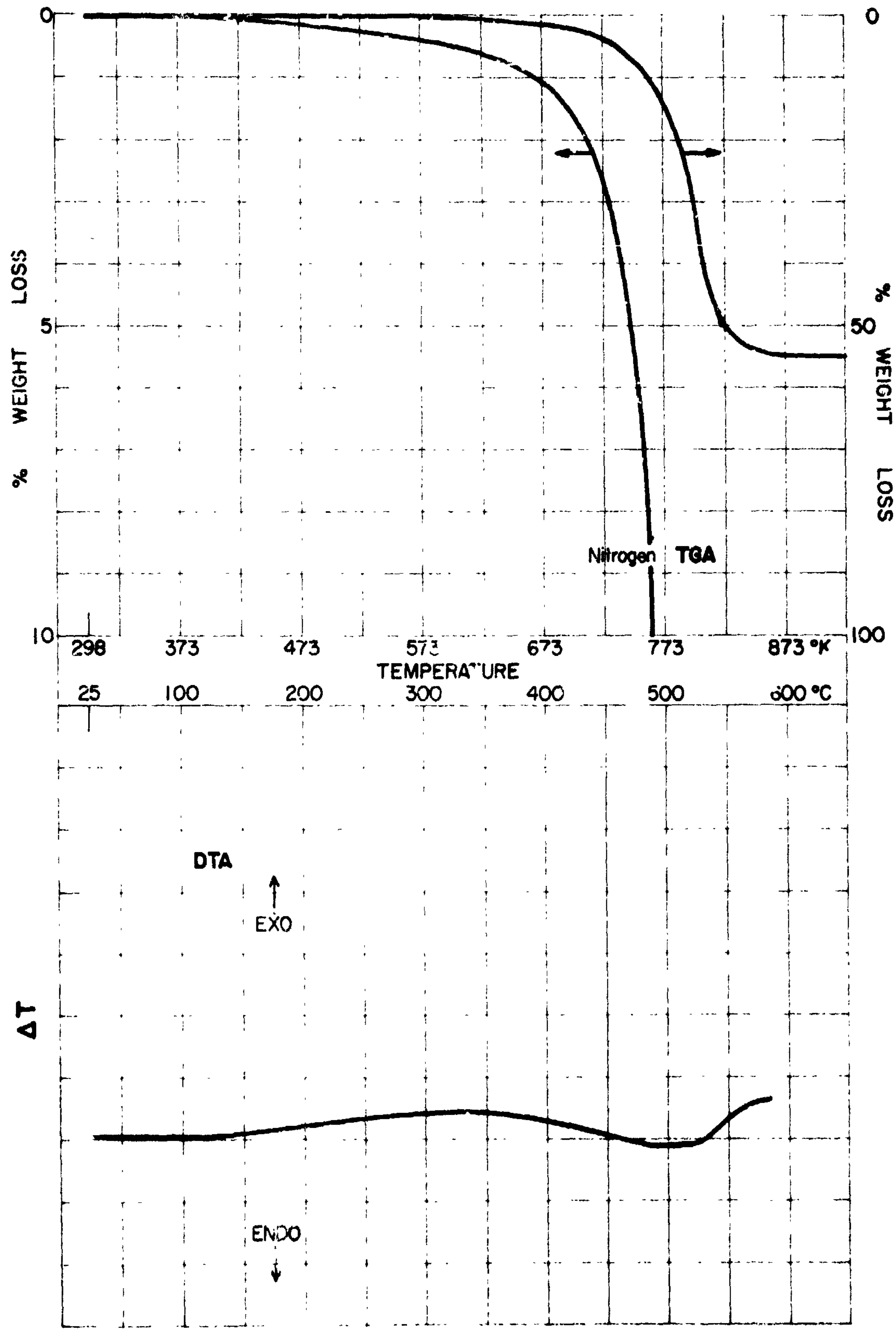
a_o = 55% of initial weight

$$k = 3x10^{11} \quad \exp\left(\frac{-43700}{1.98\ T^{o}K}\right) \quad min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50^{o}C (323^{o}K)	1.6x10^{11}	1x10^{15}
100^{o}C (373^{o}K)	6x10^{8}	1x10^{12}
150^{o}C (423^{o}K)	8x10^{6}	8.8x10^{10}


0
5
10
% WEIGHT LOSS
0
50
100
% WEIGHT LOSS
Vacuum TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
ΔP
Furnace Pressure



0
5
10
% WEIGHT LOSS
0
50
100
% WEIGHT LOSS
Nitrogen TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
DTA
EXO
ENDO
ΔT

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	250	450	500	550	650	
14	915	1059	3332	7485	2682	1473	
15	476	615	14362	37284	6347	2460	
16	5441	5263	10524	16726	8468	6872	
17	28338	24586	22344	24342	21257	20831	
18	95778	81511	72758	77961	67487	67151	
19	52	59	78	68	74	100	
20	265	272	310	421	306	277	
21							
22							
23							
24			225	416	93	46	
25	64	90	1235	2235	443	105	
26	611	532	6728	11633	2881	1000	
27	1043	908	5099	11389	2282	975	
28	15877	15827	31943	45200	22867	19126	
29	915	69[illegible]	5398	13619	1483	588	
30	460	47[illegible]	933	1564	71[illegible]	497	
31		48	226	742	104	63	
32	3573	3434	3480	3917	3199	3328	
33							
34							
35							
36				54			
37	46	45	78	115	64		
38	51	69	132	210	69	50	
39	892	505	858	1323	606	379	
40	4016	4130	5150	7041	4769	4696	
41	1871	1284	1307	1460	967	582	
42	251	181	341	804	239	150	
43	934	706	2041	4467	651	371	
44	462	554	1152	2006	783	1035	
45		44	4873	14197	792	135	
46			175	543	45		
47			760	2629	116		
48			58	80			
49			55	70			
50	94	89	109	136	63	78	
51	123	115	170	233	91	86	
52	63	63	100	219	52	62	
53	168	158	158	217	97	61	
54	122	112	71	74	63	56	
55	986	604	543	801	328	2071	
56	326	239	204	201	131	133	
57	303	197	276	554	154	97	
58	42	55	296	934	72	44	
59			3135	9248	369	79	
60			212	776	51		
61			3435	9156	357		
62			121	325	40		
63	43	42	150	321	52		
64	40	55	53	87	50	43	
65	94	90	130		86	59	
66	62	85	194	456	104	64	
67	319	183	183	274	137	113	
68	122	90	9[illegible]	87	71	43	
69	296	207	132	167	10[illegible]	103	
70	162	73	10[illegible]	121	77	54	
71	80	78	273	769	7[illegible]	46	
72			216	791	44		
73		45	6754	20746	1467	392	
74			1087	3655	127	54	
75			5132	13409	570	64	
76			215	607	53		
77	85	70	271	674	98	67	
78	51	52	81	112	76	41	
79	119	97	106	104	59	64	
80	51	44	79	152			
81	158	133	1661	4454	191	75	
82	99	68	990	2828	119	44	
83	108	83	144	284	63	45	
84	80	79	90	115	68	79	
85			159	408	48		
86			74	139	47		
87			1872	4891	172		
88			909	2678	90		
89			3015	7577	190		
90			200	582	45		
91	85	68	147	314	66	50	
92			60	52	41		

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	250	450	500	550	650	
93	49	49	40				
94			46	47			
95	88	66					
96		40	11763	44519	2044	90	
97	45	41	1994	4930	133		
98			44				
99			44	56			
100							
101			66	159			
102			257	752			
103			2488	6458	138		
104			395	1214	53		
105			443	1470	48		
106			53	120			
107			58	100			
108							
109							
110				41			
111			42	73			
112							
113				48			
114							
115			608	1792	42		
116			73	154			
117			162	485			
118			71	155			
119			860	2590	49		
120			94	183			
121			55	106			
122							
123							
124							
125				70			
126							
127							
128							
129							
130							
131							
132			54	45			
133			361	988			
134			55	87			
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Table 1 Emissivity

Exposure	Average	High	Low	Samples Tested
Baseline*	0.86	0.86	0.85	5
Heat compatibility (1)	0.86	0.86	0.86	5
Heat compatibility plus 30 day thermal vacuum (1)(2)	0.84	0.84	0.84	5

Table 2 Absorptivity

Baseline*	0.20	0.21	0.20	5
Heat Compatibility (1)	0.20	0.20	0.19	5
Heat Compatibility plus 30 day thermal vacuum (1)(2)	0.22	0.22	0.22	5

*Cured 48 hours at room temperature plus 48 hours at 255°F (397°K)

(1) Heat compatibility - 570 hours at 275°F (408°K) in N_2 atmosphere

(2) Thermal Vacuum - tested in air after the specified exposure time at 150°F (338°K) and $1x10^{-6}$ Torr

Chemical Characterization Summary

Mix ratio: 100 pbw of resin to 10 pbw of hardener
Cure: 24 hr at room temp plus 4 hr at 65°C (338°K)

1. Isothermal Weight loss in Nitrogen: 0.04%

2. Steady-State Vacuum Condensible Degassing Rate: not measurable

3. TGA Conditioning:

TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
Nitrogen: 24 hr at 23°C (296°K) and 45% RH

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 25°C-580°C (298°K-853°K)

a_0 = 12.5% of initial weight

$$k = 4.2\times10^{2} \exp\left(\frac{-12750}{1.98\ T^{\circ}K}\right) \ \text{min}^{-1}$$

In Nitrogen:

Over the range: 25°C-480°C (298°K-753°K)

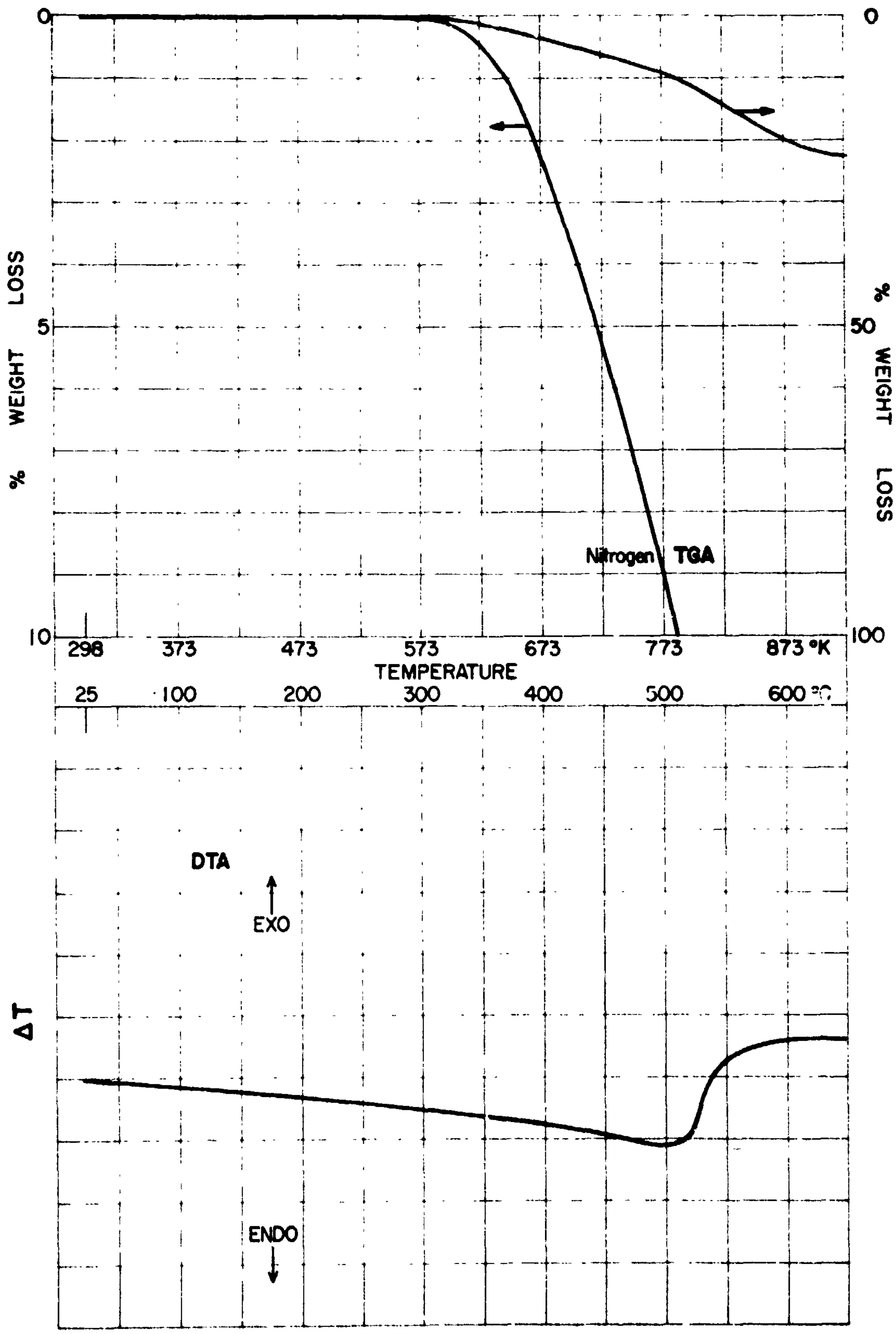
a_0 = 10% of initial weight

$$k = 100 \exp\left(\frac{-15750}{1.98\ T^{\circ}K}\right) \ \text{min}^{-1}$$

Time to 1% Weight Loss at Temperature T

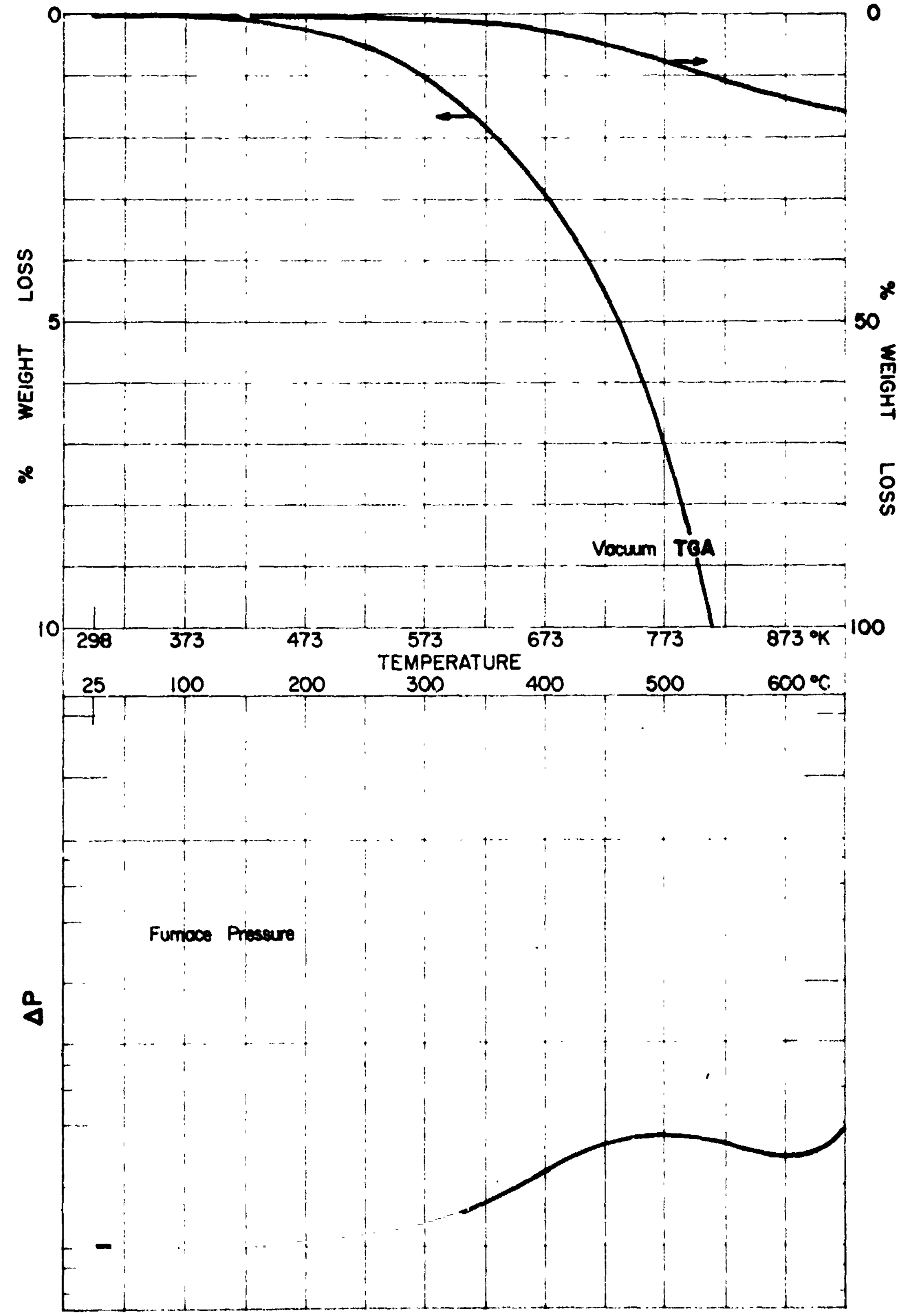
Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	6.6×10^{5}	3×10^{8}
100°C (373°K)	4.5×10^{4}	1.1×10^{7}
150°C (423°K)	5.8×10^{3}	8.7×10^{5}

DC93-500



0
5
10
% WEIGHT LOSS
0
50
100
% WEIGHT LOSS
Nitrogen TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
DTA
EXO
ΔT
ENDO

S30


0
5
10
% WEIGHT LOSS
0
50
100
% WEIGHT LOSS
Vacuum TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
Furnace Pressure
ΔP

MASS NUMBER AND RELATIVE PEAK INTENSITY
TEMPERATURE, °C

m/e	25	150	350	550			
14	895	866	1355	4117			
15	192	210	2041	14292			
16	2741	2684	4720	19206			
17	8786	7669	7305	7087			
18	27450	23652	21323	19257			
19	283	344	336	445			
20	176	159	169	173			
21							
22							
23							
24				47			
25			47	191			
26	85	115	318	1532			
27	229	257	495	1615			
28	14188	13971	14779	17521			
29	1767	1722	1471	1450			
30	1337	1791	1634	1632			
31			58				
32	3355	3178	3051	2993			
33							
34							
35							
36				50			
37							
38			43	[illegible]			
39			60	234			
40	1207	1267	1368	1721			
41			52	231			
42				148			
43	51	59	124	147			
44	653	695	698	670			
45		41	158	280			
46			56	43			
47							
48							
49							
50			48	73			
51			52	66			
52			47				
53							
54							
55							
56							
57							
58							
59			50	102			
60							
61				41			
62							
63							
64							
65							
66							
67							
68							
69							
70							
71							
72							
73			[illegible]	[illegible]			
74				53			
75			258	155			
76							
77			47	56			
78			111	100			
79							
80							
81							
82							
83							
84							
85							
86							
87							
88							
89							
90							
91							
92							

Table 1. Dielectric Strength* (ASTM D149-70)

Exposure	Nominal Thickness		[illegible]		[illegible]		Low		Samples Tested
	mil	m $\times 10^{-3}$	Volts/m $\times 10^7$	Volts/mil	Volts/m $\times 10^7$	[illegible]	Volts/m $\times 10^7$	Volts/mil	
Baseline	125	3.2	1.5	[illegible]	1.5	386	1.5	386	2
Heat Compatibility(1)	125	[illegible]	1.6	403	1.6	410	1.5	392	4
Thermal Vacuum (2)	125	3.2	1.2	307	1.3	332	1.1	285	4

Table 2. Dielectric Constant* (ASTM D150-68)

@ 1 MHz

Exposure	Average	High	Low	Samples Tested
Baseline	2.79	2.81	2.78	3
Heat Compatibility (1)	2.76	2.78	2.74	3
Thermal Vacuum (2)	2.76	2.84	2.68	3

*Cured 24 hours at room temperature plus 4 hours @ 65°C (338°K)

(1) 379 hours at 275°F (408°K) in N_2 atmosphere

(2) Tested at 1×10^{-5} Torr after 1100 hours at 150°F (338°K) at 1×10^{-6} torr preceded by heat compatibility

MS40G08

Chemical Characterization Summary

Mix ratio: As received
Cure: As received

1. Isothermal Weight loss in Nitrogen: 0.92%

2. Steady-State Vacuum Condensible Degassing Rate: 4.06×10^{-4} %/day

3. TCA Conditioning:

TCA Vacuum: 24 hr at 23°C (296°K) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 25°C-450°C (298°K-723°K)

a_o = 14% of initial weight

$$k = 3.5 \times 10^{8} \exp\left(\frac{-32000}{1.98\ T^{\circ}K}\right) \text{min}^{-1}$$

In Nitrogen:

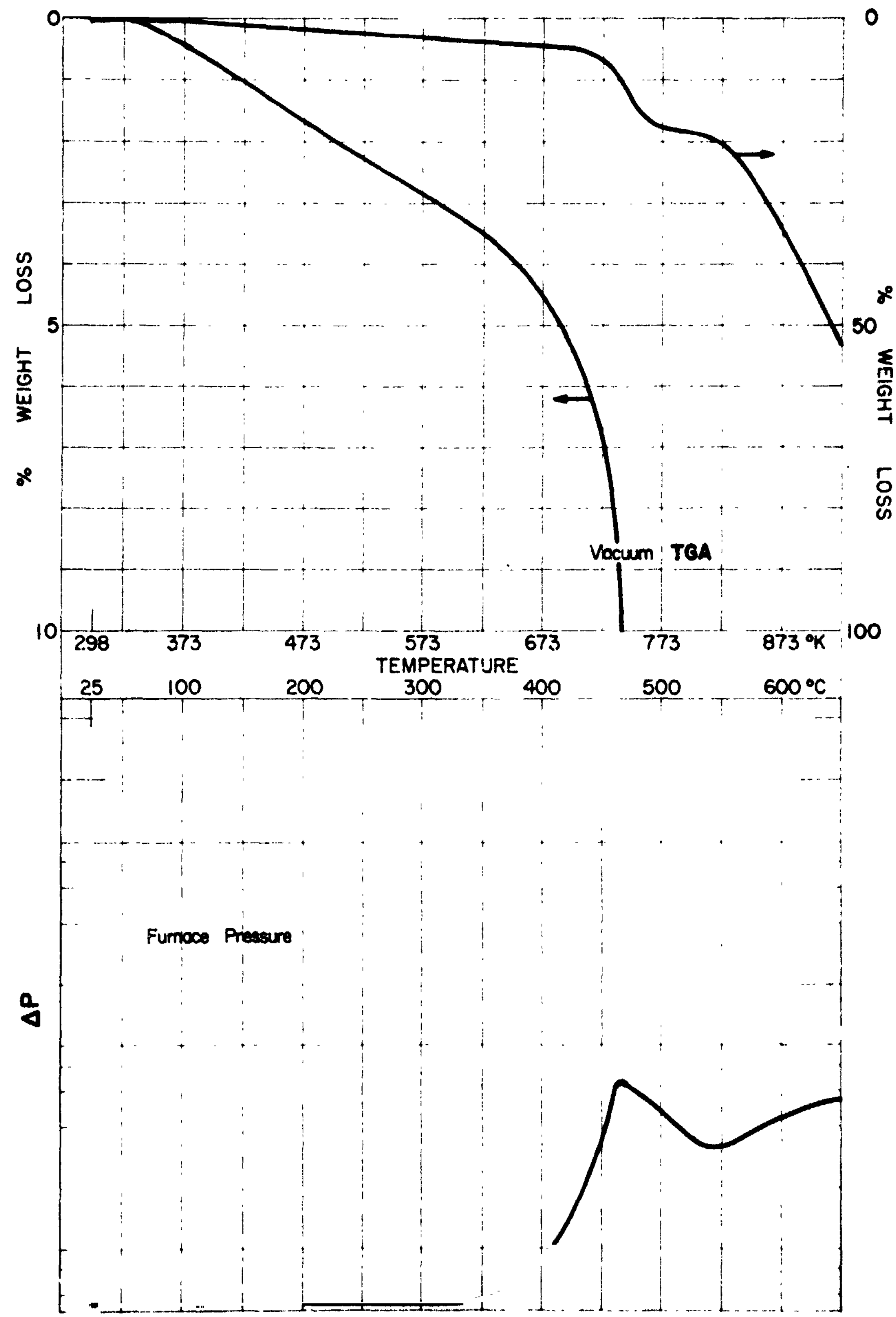
Over the range:

a_o = of initial weight

$$k = \exp\left(\frac{-}{1.98\ T^{\circ}K}\right) \text{min}^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	9.6×10^{12}	
100°C (373°K)	1.2×10^{10}	
150°C (423°K)	6.6×10^{7}	


0
5
10
0
50
100
% WEIGHT LOSS
% WEIGHT LOSS
Vacuum TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
Furnace Pressure
ΔP

MS40G08

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	200	450	550	650		
14	1933	1858	3935	4512	6325		
15	276	324	9408	10575	17219		
16	2564	2348	5244	5832	9203		
17	9927	7762	5922	5513	5369		
18	33943	26347	19281	17467	16897		
19	148	170	229	225	210		
20	175	163	152	163	186		
21							
22							
23							
24			208	200	335		
25			813	819	1298		
26	94	148	3903	4134	6091		
27							
28	21719	20672	29333	28529	32287		
29	266	330	2621	2384	3454		
30	268	260	453	401	551		
31					375		
32	5290	4873	4002	3788	3752		
33							
34							
35							
36							
37			40		56		
38			75	55	90		
39			309		513		
40	1481	1426	1754	1784	2006		
41			175	193	282		
42			183	155	297		
43		48	766	673	1168		
44	322	370	611	709	832		
45			2352	2157	4645		
46			84	82	200		
47			410	315	599		
48							
49							
50			107	55	63		
51			117	71	61		
52			100	52	52		
53				43	51		
54							
55			56	44	80		
56							
57			69	49	113		
58			130	109	247		
59			1402	1246	2802		
60			86	78	172		
61			1276	994	1464		
62			50		52		
63			59	43	50		
64							
65			55				
66			90	70	109		
67							
68							
69							
70							
71			109	78	152		
72			112	93			
73			3795	4639	17378		
74			575	525	1660		
75			1916	1500	2672		
76			89	60	108		
77			112	73	94		
78			222	85	54		
79					62		
80							
81			661	420	100		
82			335	262	370		
83			46		50		
84	43		47	47	69		
85			66	44	107		
86							
87			656	475	737		
88			381	228	362		
89			1081	781	1077		
90			82	45	73		
91			61	46	47		
92							

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	200	450	550	650		
93							
94							
95							
96			5919	4160	5440		
97			631	419	567		
98							
99							
100							
101							
102			117	69	99		
103			1062	750	1003		
104			186	117	169		
105			242	139	212		
106							
107							
108							
109							
110							
111							
112							
113							
114							
115			312	220	304		
116							
117			86	74	102		
118							
119			484	344	418		
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133			522	293	422		
134			413		369		
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Silicone Tape Series 600

Chemical Characterization Summary

Mix ratio: As received
Cure: 48 hr at room temperature

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: None (Room Ambient)
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: $130^{\circ}C-575^{\circ}C$ ($403^{\circ}K-843^{\circ}K$)

a_o = 27% of initial weight

$$k = 6.8\times10^{7} \exp\left(\frac{-31500}{1.98\ T^{\circ}K}\right) \quad min^{-1}$$

In Nitrogen:

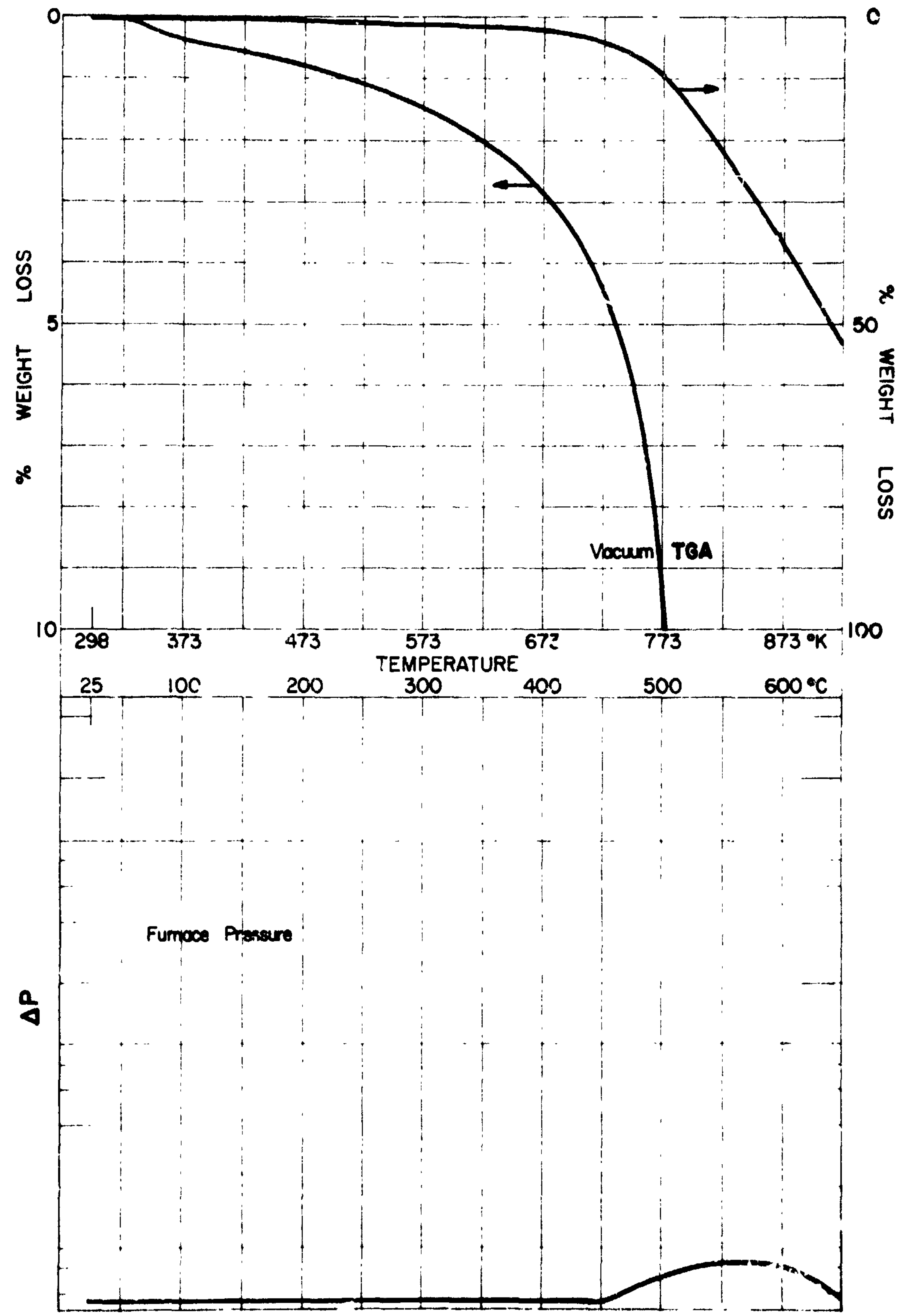
Over the range:

a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{\circ}K}\right) \quad min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
$50^{\circ}C$ ($323^{\circ}K$)	2.2×10^{13}	
$100^{\circ}C$ ($373^{\circ}K$)	3.0×10^{10}	
$150^{\circ}C$ ($423^{\circ}K$)	1.9×10^{8}	


% WEIGHT LOSS
0
5
10
% WEIGHT LOSS
0
50
100
Vacuum TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
Furnace Pressure
ΔP

Silicone Tape Series 600

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	300	450	600			
14	18557	18560	27687	5137			
15	4437	6218	50219	11893			
16	47685	46820	53064	7680			
17	99567	99615	99621	11267			
18	99569	99621	99617	31376			
19	963	921	943	185			
20	3127	3076	3125	348			
21							
22	44	93	86				
23							
24	53	107	506				
25	157	438	2000				
26	1878	3094	19758	2474			
27	5265	6440	12419	3176			
28	99633	99694	99699	31204			
29	3748	5310	10116	2665			
30	16771	17151	17289	1584			
31	969	2401	4064	513			
32	56033	53050	49405	4616			
33	64	90	104				
34	237	193	209				
35							
36	106	138	295				
37	50	159	763				
38	110	294	1189				
39		979	3492	464			
40	26637	27368	26788	3017			
41	499	1198	2596	238			
42	433	845	1651	120			
43	1072	1649	2824	839			
44	9174	11827	11244	1103			
45	134	360	3125	3953			
46		76	210	87			
47			524	353			
48			181				
49		69	454				
50	83	457	2314	160			
51	80	402	2053	189			
52	58	284	1817	153			
[illegible]		102	317				
[illegible]		49	152				
[illegible]	55	170	373				
[illegible]		417	574				
[illegible]		72	30[illegible]				
[illegible]		59	262	86			
[illegible]			1846	2653			
[illegible]			206	97			
[illegible]		81	1397	1141			
[illegible]			176				
[illegible]		89	472				
64		46	85				
[illegible]	40	86	176				
66		100	229				
67		41	137				
68			62				
69			48				
70			46				
71			149	53			
72			214				
73			7847	22724			
74		63	1151	2093			
75		65	2223	2572			
76		41	392	66			
77		219	1308	188			
78	53	731	5160	710			
79		50	387				
80			61				
81			753	559			
82			429	277			
83			88				
84			43				
85			117	64			
86			52				
87			783	774			
88			502	379			
89			1368	1152			
90			144				
91			257				
92			106				

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	300	450	600			
93							
94		40	86				
95			40				
96		129	8098	7292			
97							
98			90				
99							
100							
101			62				
102			205	76			
103			1646	1468			
104			403	249			
105			513	331			
106			95				
107			49				
108			41				
109							
110							
111			74				
112			46				
113							
114							
115			776	621			
116			95				
117			330	288			
118			136	44			
119			1363	12[illegible]			
120			111				
121			128				
122			77				
123							
124							
125			261	108			
126			217	60			
127							
128							
129			71				
130							
131			135				
[illegible]	48		209				
[illegible]			3360	34[illegible]4			
[illegible]4			584	39[illegible]			
135			313	150			
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146			49				
147			527	878			
148			54				
149				63			
150			133				
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161			160	64			
162			58				
163			305	251			
164							
165			42				
166			114				
167							
168							
169							
170							
171							

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

m/e	TEMPERATURE, °C 25	300	450	600			
172							
173							
174							
175							
176							
177			475				
178				366			
179			57				
180			122				
181							
182							
183							
184							
185							
186							
187							
188							
189							
190							
191							
192			822	727			
193			98				
194			364	366			
195			54				
196							
197							
198							
199							
200							
201							
202							
203							
204							
205							
206							
207							
208		53	4855	4764			
209			884	835			
210			501	373			
211							
212							
213							
214							
215							
216							
217							
218							
219							
220							
221							
222							
223							
224							
225							
226							
227							
228							
229							
230							
231							
232							
233							
234							
235							
236							
237							
238							
239							
240							
241							
242							
243							
244							
245							
246							
247							
248							
249							
250							

Chemical Characterization Summary

Mix ratio: pbw, 100:82:40:0.5::resin;ZnO:toluene:dibutyltindilaurate
Cure: 24 hr at room temp followed by 24 hr at 225°F (397°K)

1. Isothermal Weight loss in Nitrogen: 0.05%

2. Steady-State Vacuum Condensible Degassing Rate: 2.1×10^{-6} %/day

3. TGA Conditioning:

TGA
Vacuum: 100 hr at 125°C(398°K) in N_2 atmosphere
Nitrogen: 24 hr at 23°C (296°K) and 45% RH

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 350°C-700°C (623°K-973°K)

a_o = 69% of initial weight

$$k = 1.1\times10^{5} \exp\left(\frac{-22500}{1.98\ T^{\circ}K}\right) \ \text{min}^{-1}$$

In Nitrogen:

Over the range: 350°C-650°C (623°K-923°K)

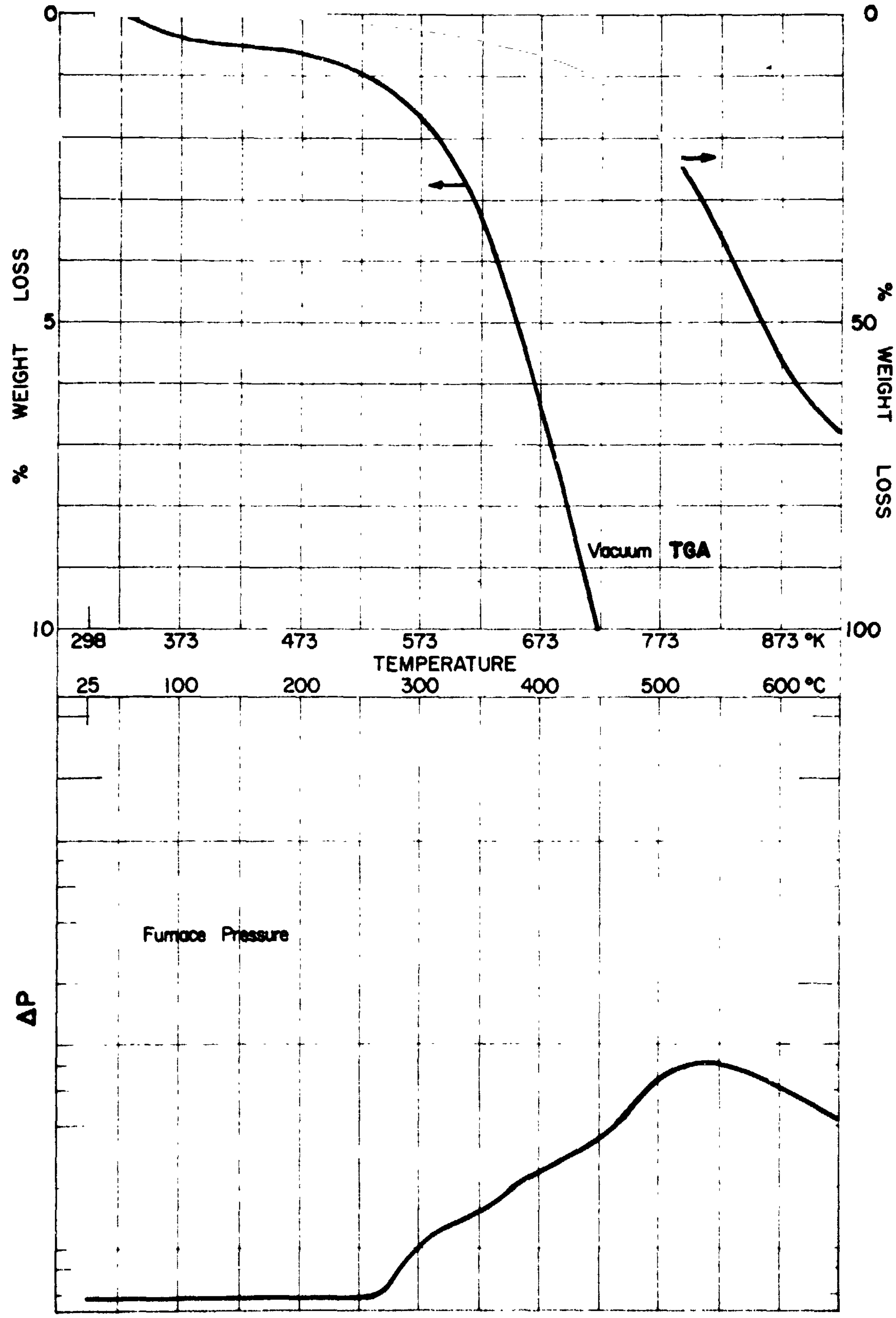
a_o = 68% of initial weight

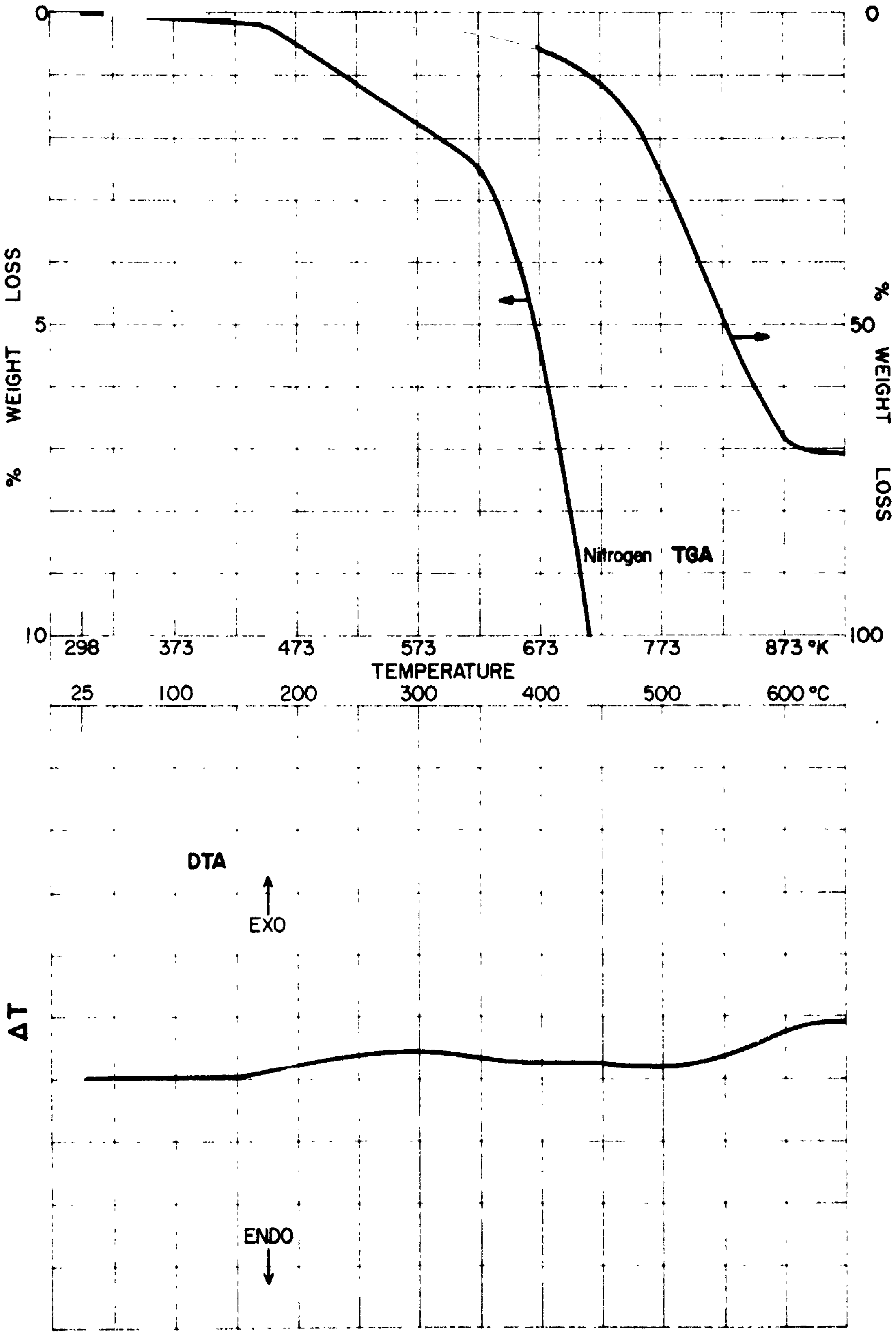
$$k = 2.2\times10^{6} \exp\left(\frac{-26100}{1.98\ T^{\circ}K}\right) \ \text{min}^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	1.1×10^{10}	1.5×10^{11}
100°C (373°K)	9.6×10^{7}	6.3×10^{8}
150°C (423°K)	2.5×10^{6}	9.1×10^{6}

RTV-511, Modified





% WEIGHT LOSS
% WEIGHT LOSS
0
5
10
0
50
100
Nitrogen TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
DTA
EXO
ΔT
ENDO

RTV 511, Modified

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	200	350	500	600		
14	432	436	911	1491	989		
15	83	86	1262	4545	2715		
16	1718	1662	1782	2751	2178		
17	11201	9482	7261	5144	4756		
18	42528	35361	26105	17789	16362		
19		42					
20	72	55	50				
21							
22							
23							
24				76	48		
25			87	366	164		
26		47	552	2487	1418		
27	90	117	268	936	414		
28	11522	11322	11845	12338	9579		
29	100	113	215	842	350		
30	250	282	270	215	178		
31	45	47	47	73	58		
32	2736	2548	1848	117	1115		
33							
34							
35							
36							
37	418			42			
38			47	58	49		
39				172	133		
40		440	391	380	286		
41			51	72	60		
42							
43		43	61	186	106		
44	324	409	379	677	281		
45			75	905	485		
46				99	68		
47							
48							
49					82		
50				144			
51				153	111		
52				123			
53							
54							
55							
56							
57							
58				48			
59			46	512	285		
60				50			
61			43	490	147		
62							
63				42			
64							
65							
66							
67							
68							
69							
70				43			
71							
72				59			
73			117	3418	4197		
74			63	297	202		
75				1017	335		
76				48			
77				130	69		
78			55	472	234		
79				48			
80							
81				224	72		
82				144	41		
83							
84							
85							
86							
87				253	81		
88				97			
89				[illegible]	91		
90							
91				65	75		
92							

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

m/e	TEMPERATURE, °C 25	200	350	500	600		
93							
94							
95							
96			386	4453	1113		
97				245	67		
98							
99							
100							
101							
102					41		
103				289			
104				41			
105				68			
106							
107							
108							
109							
110							
111							
112							
113							
114							
115				83			
116							
117							
118							
119				88			
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133				53			
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

RTV 511, modified

Table 1 Emissivity, Normal

Exposure	Average	High	Low	Samples Tested
Baseline*	0.90	0.90	0.90	5
Heat compatibility (1)	0.90	0.90	0.90	5
Heat compatibility plus 30 day thermal vacuum (1)(2)	0.89	0.89	0.88	5

Table 2 Absorptivity, Solar

Baseline*	0.23	0.23	0.23	5
Heat compatibility (1)	0.23	0.24	0.23	5
Heat compatibility plus 30 day thermal vacuum (1)(2)	0.26	0.26	0.26	5
Heat compatibility plus 90 day thermal vacuum (1)(2)	0.25	0.25	0.25	

*Cured 24 hours at room temperature plus 24 hours at 255°F (397°K)

(1) Heat compatibility - 570 hours at 275°F (408°K) in N_2 atmosphere

(2) Thermal Vacuum - tested in air after the specified exposure time at 150°F (338°K) and 1×10^{-6} Torr

Chemical Characterization Summary

Mix ratio: As received
Cure: As received

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate: 1.6×10^{-3} %/day

3. TGA Conditioning:

TGA Vacuum: 24 hrs at $23^{o}C$ ($296^{o}K$) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: $300^{o}C - 600^{o}C$ ($573^{o}K - 873^{o}K$)

a_o = 16% of initial weight

$$k = 1.1 \times 10^{6} \exp\left(\frac{-24800}{1.98\ T^{o}K}\right) \ \min^{-1}$$

In Nitrogen:

Over the range:

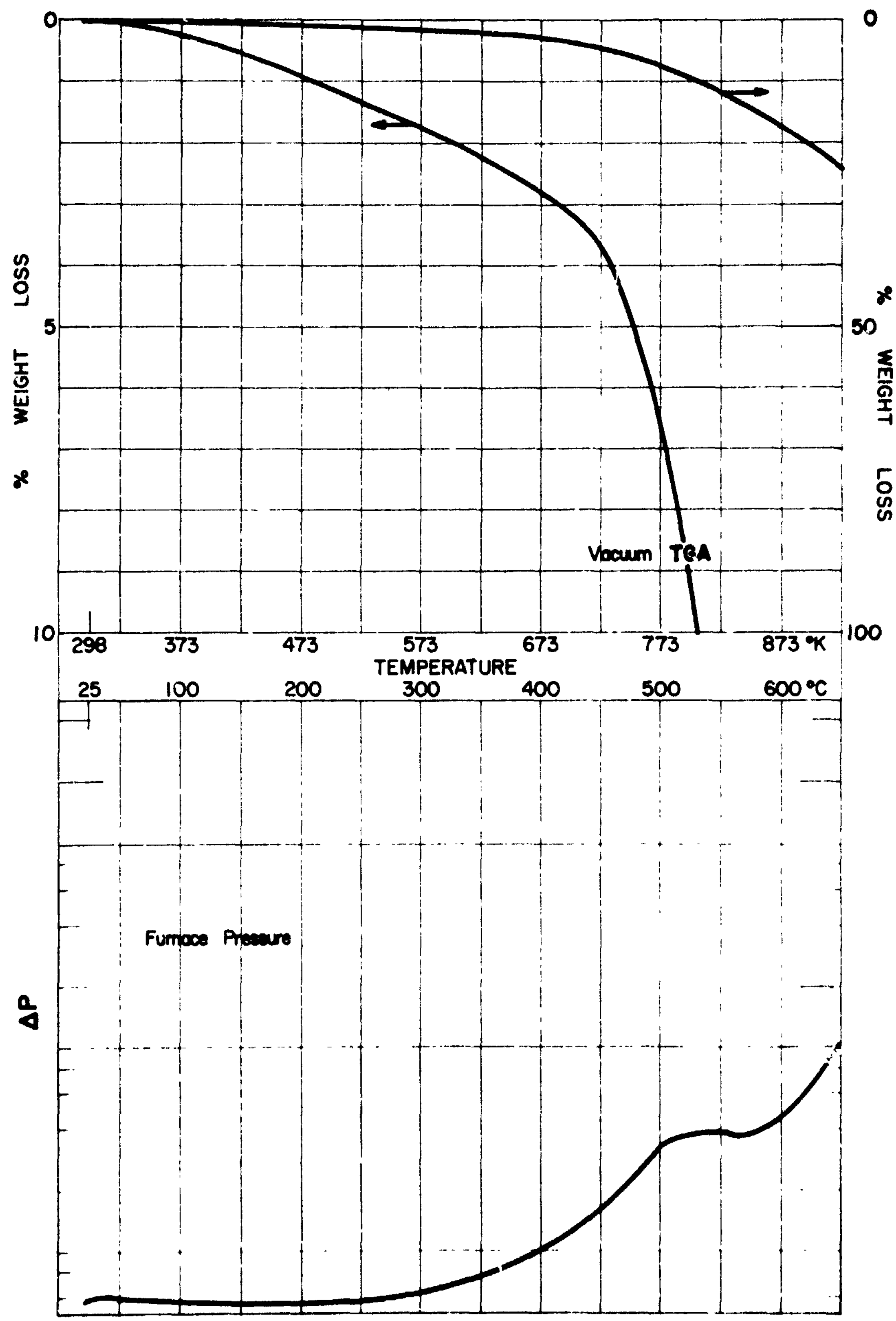
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \ \min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
$50^{o}C$ ($323^{o}K$)	4×10^{10}	
$100^{o}C$ ($373^{o}K$)	2.1×10^{8}	
$150^{o}C$ ($423^{o}K$)	4×10^{6}	

ZP 5044 Silicone Gasket



S50

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, ^{o}C

m/e	25	300	500	650	800		
14	630	1129	1617	1760	1819		
15	205	306	2082	4926	6995		
16	1258	2036	2710	4108	9751		
17	5940	5595	5524	4901	5476		
18	[illegible]	25336	16651	18874	19936		
19	[illegible]	371	770	874	1905		
20	291	415	439	502	514		
21							
22							
23							
24		76	81	259	70		
25	65	185	440	852	245		
26	[illegible]	657	2476	4344	1700		
27	54[illegible]	913	1591	3541	1751		
28	23460	35336	36876	[illegible]9920	39183		
29	635	946	1452	2870	1355		
30	305	556	422	756	697		
31	340	397	310	488	456		
32	4151	6013	5097	5164	5529		
33							
34							
35							
36	47	42	59	52			
37		47	173	181	122		
38	[illegible]	72	273	230	208		
39	113	229	851	990	971		
40	2183	3395	3083	3765	4105		
41	155	256	294	701	1396		
42	103	128	197	432	243		
43	429	649	747	1324	646		
44	72[illegible]	1000	933	1508	2411		
45	71	58	895	2499	115		
46			47	110			
47			216	529	129		
48							
49			136	119	47		
50		55	680	386	177		
51	48	77	603	399	159		
52	41	42	407	410	60		
53			52	135	76		
54							
55		40	44	125	159		
56	17	51		58	194		
57	42	71	41	96	43		
58			59	233			
59			413	1238			
60			46	103			
61			299	1064			
62			44	56			
63			96	143			
64							
65			62	81			
66			40	68			
67				47			
68							
69	93	69	40	60	62		
70							
71				91			
72		49	50	116			
73			1428	2339	44		
74			229	350			
75			292	1035			
76			61	84			
77			162	196	42		
78			710	295			
79			59	46			
80							
81			79	325	86		
82				122			
83							
84							
85				54			
86							
87			76	230			
88				138			
89			43	262			
90							
91				119			
92							

ZP5044 Silicone Gasket

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	300	500	650	800		
93							
94							
95				82			
96			298	1146			
97			43	196			
98							
99							
100							
101							
102							
103				138			
104							
105				44			
106							
107							
108							
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: As received
Cure: As received

1. Isothermal Weight loss in Nitrogen: 0.75%

2. Steady-State Vacuum Condensible Degassing Rate: 3.700×10^{-5} %/day

3. TGA Conditioning:

TGA Vacuum: 100 hr at 125°C (398°K) in N_2 atmosphere
Nitrogen: 24 hr at 23°C (296°K) and 45% RH

4. Activation Energy of Decomposition:

In Vacuum

Over the range: 140°C-300°C (413°K-573°K)

a_o = 5% of initial weight

$$k = 1\times10^{5} \exp\left(\frac{-16800}{1.98\ T^{o}K}\right) \min^{-1}$$

In Nitrogen:

Over the range: 140°C-300°C (413°K-573°K)

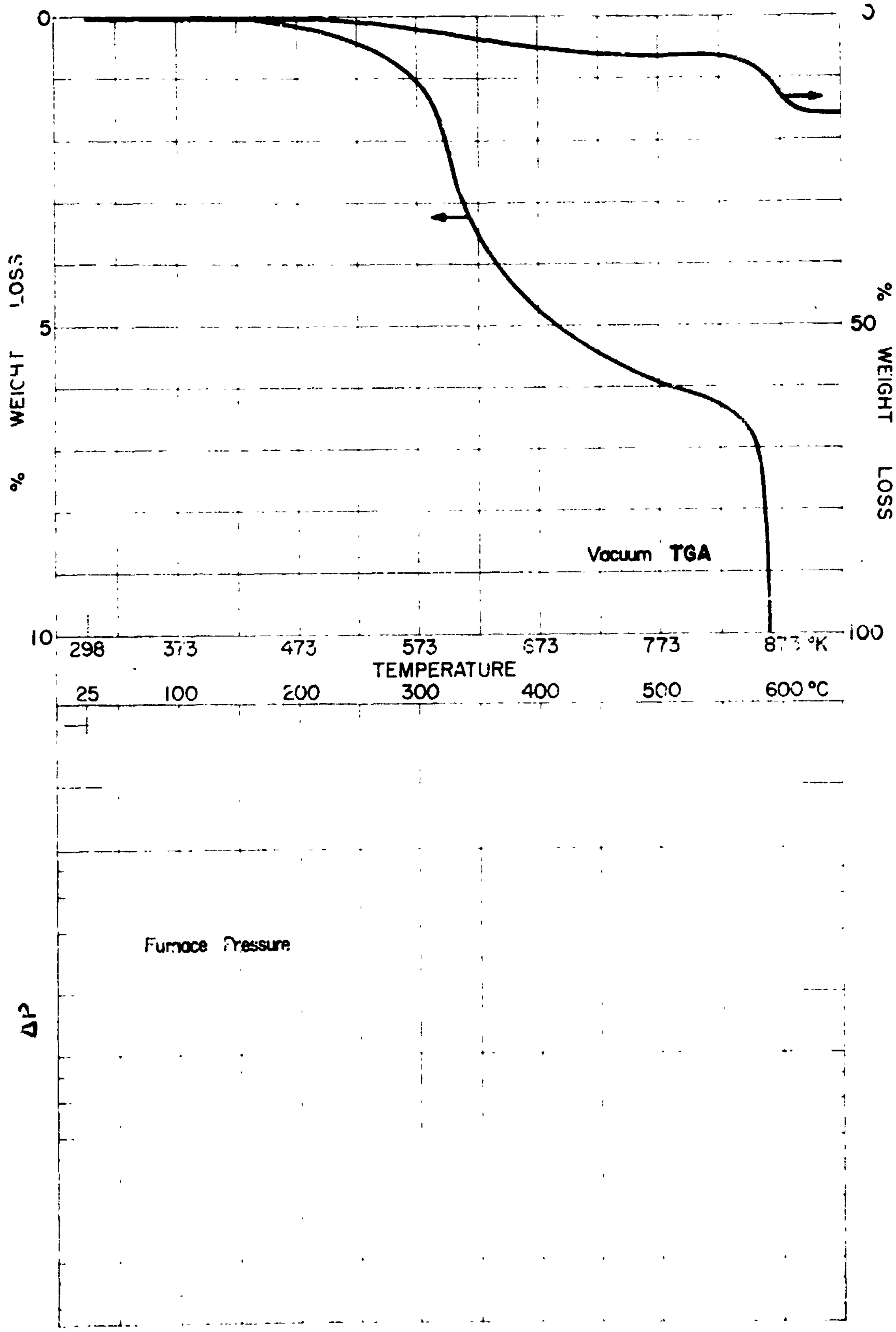
a_o = 5% of initial weight

$$k = 1.4\times10^{3} \exp\left(\frac{-12400}{1.98\ T^{o}K}\right) \min^{-1}$$

Time to 1% Weight Loss at Temperature T

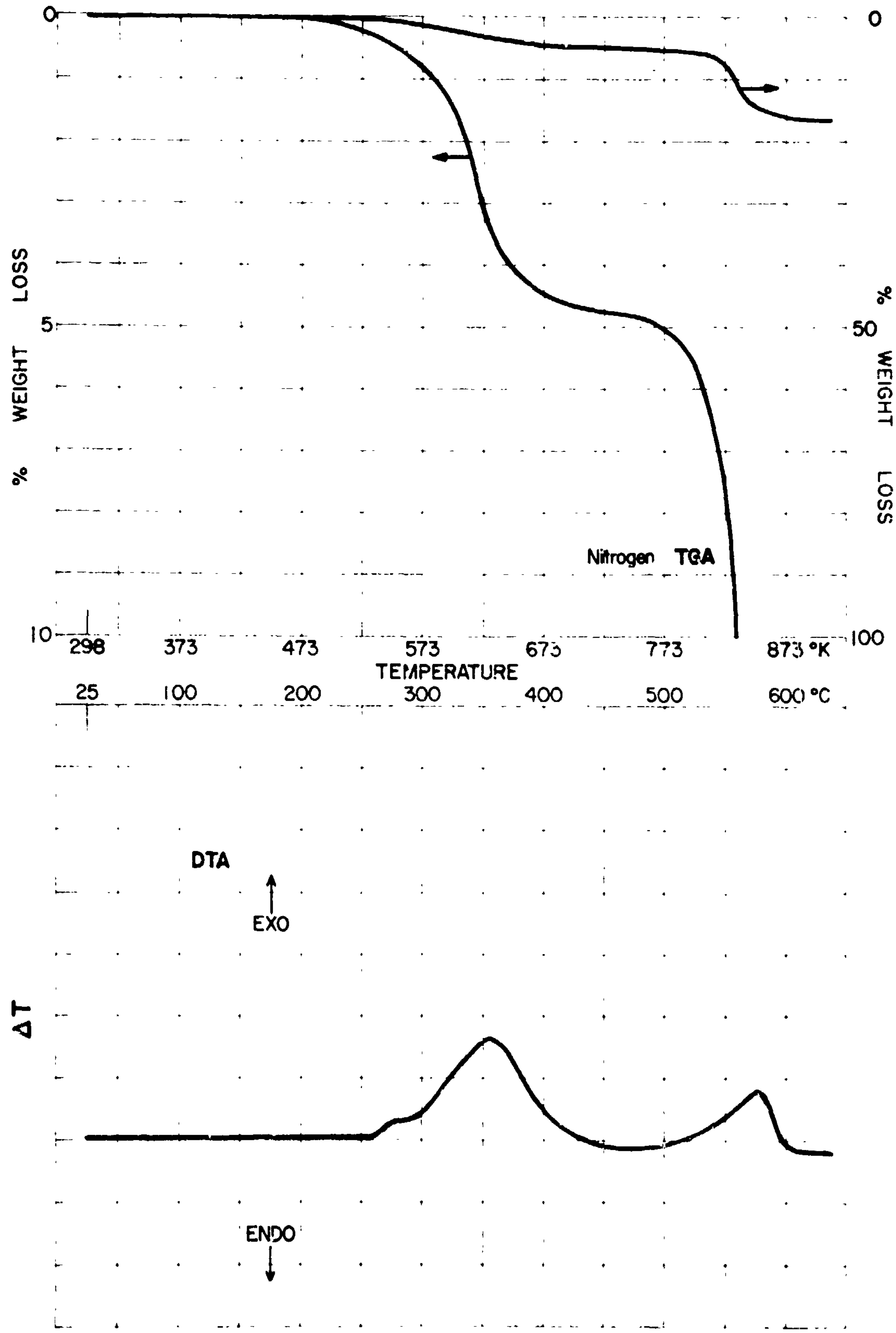
Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	1.6×10^{6}	1.2×10^{5}
100°C (373°K)	4.6×10^{4}	8.5×10^{3}
150°C (423°K)	3×10^{3}	1.1×10^{3}

Teflon Lacing Tape



T2

Teflon Lacing Tape



Teflon Lacing Tape

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	300	450	550	650		
14	140	418	161	140	129		
15	56	354	78	60	55		
16	798	848	621	714	567		
17	5496	4084	3508	3120	3042		
18	20230	14405	12325	11199	10463		
19							
20				47	60		
21							
22							
23							
24				43			
25							
26		90	53	44			
27		94	77	60			
28	3742	4536	3649	3898	3509		
29		223	82	63	45		
30	43	83	54	67	48		
31		57		5161			
32	744	657	555	625	532		
33							
34							
35							
36							
37							
38							
39			44				
40	139	13[illegible]	131	206	105		
41		8[illegible]	80				
42		184					
43		1018	58	83			
44	92	308	197	153	262		
45		729					
46							
47							
48							
49							
50				1657			
51							
52							
53							
54							
55			45				
56							
57							
58							
59							
60		2[illegible]					
61							
62							
63							
64							
65							
66							
67							
68							
69				76			
70							
71							
72							
73							
74							
75							
76							
77							
78							
79							
80							
81				1769			
82							
83							
84							
85							
86							
87							
88							
89							
90							
91							
92							

Table 1. Tensile Strength (FTMS 191 Method 4102)

Exposure	Average		High		Low		Samples Tested
	lb	N	lb	N	lb	N	
Baseline	132	587	133	592	130	578	5
Heat compatibility (1)	167	743	176	783	149	663	5
30 day thermal vacuum (2)	186	[illegible]	207	921	174	774	5
90 day thermal vacuum (2)	186	827	195	867	180	801	5

(1) 580 hours at 275°F (408°K) in N_2 atmosphere

(2) Tested at a pressure of 1×10^{-5} Torr after heat compatibility (1) followed by exposure for the specified length of time to 1×10^{-6} Torr at room temperature.

Table 2. Knot Breaking Strength (MMC-STM F420)*

Exposure	Average		High		Low		Samples Tested
	lb	N	lb	N	lb	N	
Baseline	38	169	42	187	31	138	5
Heat compatibility (1)	42	137	45	200	40	178	5
30 day thermal vacuum (2)	50	222	50	222	48	214	5
90 day thermal vacuum (2)	50	222	55	245	44	196	5

*The specimens shall be made by tying two 18-inch lengths of the tape together using the common square knot and leaving the tied ends approximately two inches long. Pull the knot tight. Secure the specimens in a tensile testing maching and pull at a rate of approximately 12 inches per minute.

(1) 580 hours at 275°F (408°K) in N_2 atmosphere

(2) Tested at a pressure of $1x10^{-5}$ Torr after heat compatibility (1) followed by exposure for the specified length of time to $1x10^{-6}$ Torr at room temperature.

Chemical Characterization Summary

Mix ratio: As received
Cure: As received

1. Isothermal Weight loss in Nitrogen: 0.01%

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 450°C- 580°C (723°K-853°K)

a_o = 6% of initial weight

$$k = 1.5\text{x}10^{21} \exp\left(\frac{-81000}{1.98\ T^{o}K}\right) \ \text{min}^{-1}$$

In Nitrogen:

Over the range:

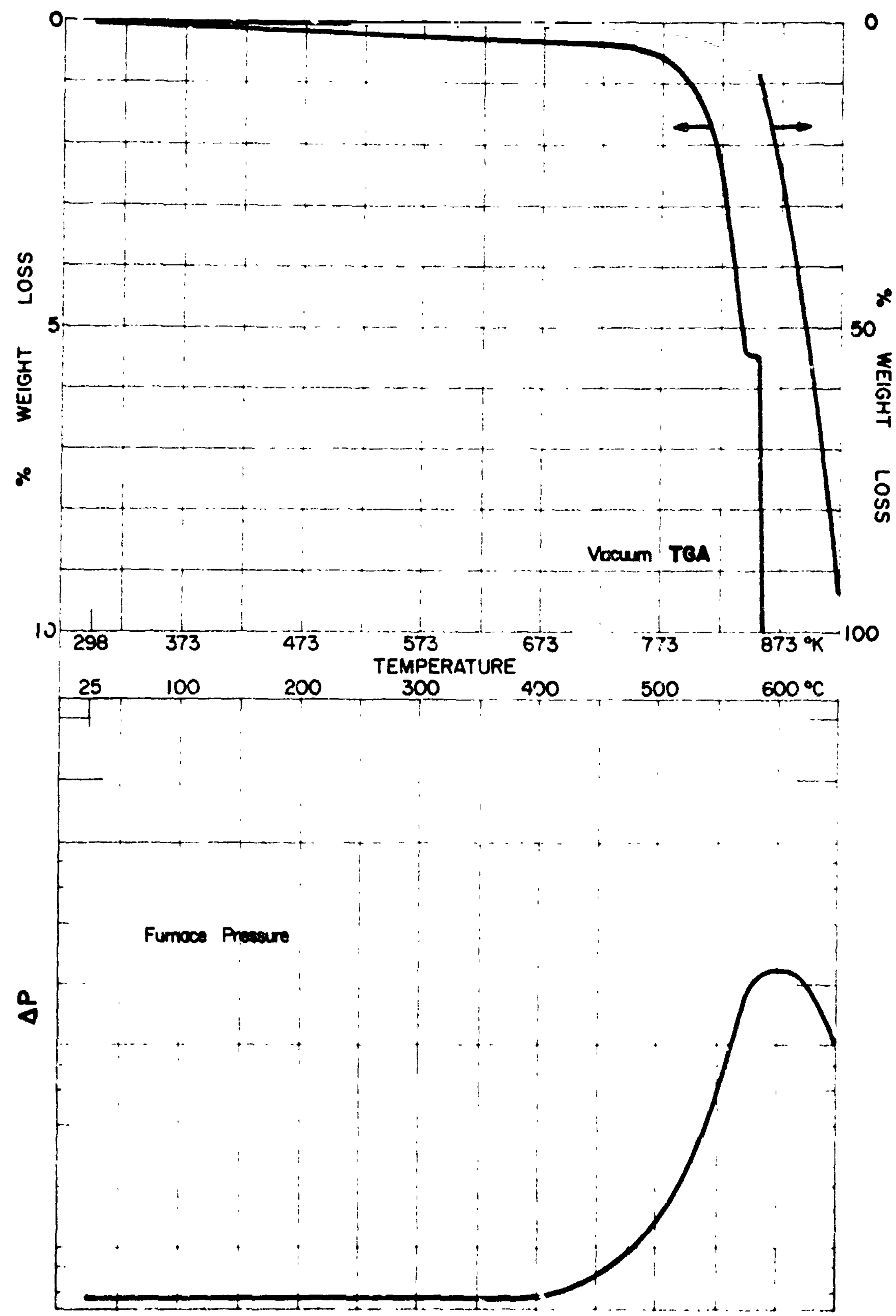
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \ \text{min}^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	$4.6\text{x}10^{33}$	
100°C (373°K)	$1.9\text{x}10^{25}$	
150°C (423°K)	$3.9\text{x}10^{20}$	

Teflon Sheet TFE Mil-P-22241



MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	400	550	625	700		
14	671	646	935	1679	800		
15	76	108	124	200	124		
16	2507	2189	2694	4316	3062		
17	8665	6165	6183	6551	5728		
18	28427	18975	17831	16421	15424		
19	48	57	1341	7209	2843		
20	60	67	264	1299	474		
21							
22							
23							
24			1076	6021			
25				97			
26	49	60	70	234	73		
27	139	134	264		282		
28	9986	9571	16215	37205	14615		
29	57	57	107	313	105		
30	463	502			970		
31			59902	101087			
32	2865	2627	4002	8424	2544		
33					43		
34							
35				55			
36							
37							
38							
39							
40	747	748	2215	5908	1304		
41							
42							
43			9[illegible]1	4952	66		
44	230	243	772	3648	5280		
45				62	54		
46							
47			42	123	156		
48							
49							
50			19775	89082	145		
51				758			
52							
[illegible]							
54							
[illegible]				194			
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]			666	3951			
[illegible]							
64							
[illegible]				136			
66							
67							
68							
69			4967	22323			
70				83			
71							
72							
73							
74			52	283			
75							
76							
77							
78							
79							
80							
81			28551	101059	180		
82			310	2219			
83							
84							
85				488	3576		
86					74		
87							
88							
89							
90							
91							
92							

Teflon Sheet, TFE

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	400	550	625	700		
93			68	669			
94							
95							
96							
97							
98				50			
99							
100			8304	34673			
101			61	385			
102							
103							
104							
105							
106							
107							
108							
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131			42	215			
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: As received
Cure: Shrunk with heat gun at temperatures in excess of $350^{\circ}F$ ($450^{\circ}K$)

1. Isothermal Weight loss in Nitrogen: 0.01%

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: 24 hr at $23^{\circ}C$ ($296^{\circ}K$) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: $380^{\circ}C$-$560^{\circ}C$ ($653^{\circ}K$-$833^{\circ}K$)

a_o = 23% of initial weight

$$k = 3.3\times10^{18} \exp\left(\frac{-69300}{1.98\ T^{\circ}K}\right) \min^{1}$$

In Nitrogen:

Over the range:

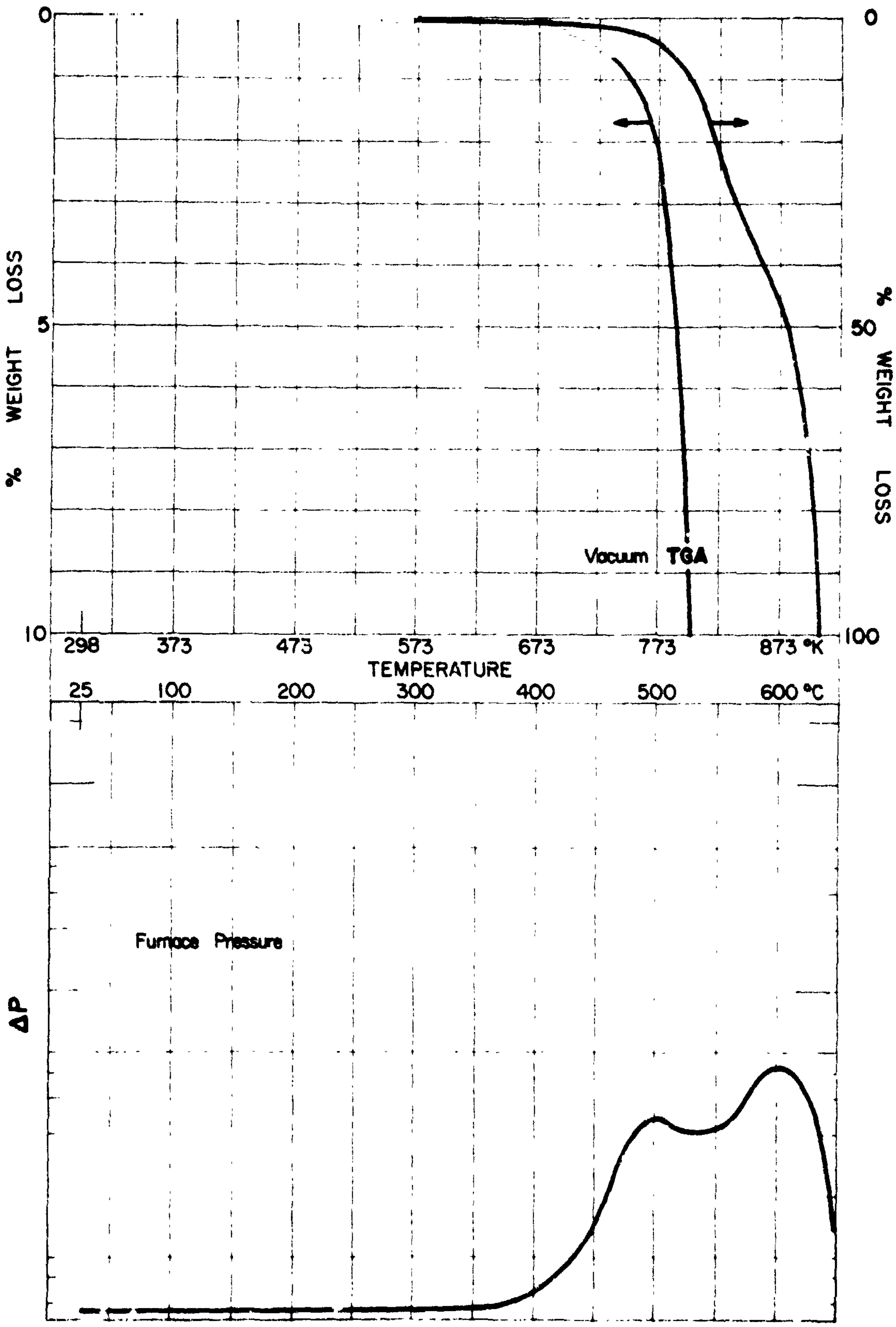
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{\circ}K}\right) \min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
$50^{\circ}C$ ($323^{\circ}K$)	2×10^{28}	
$100^{\circ}C$ ($373^{\circ}K$)	1×10^{22}	
$150^{\circ}C$ ($423^{\circ}K$)	1.5×10^{17}	

Teflon Tubing FEP



MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	300	475	550	625	700	
14	769	738	963	1224	1751	9[illegible]2	
15	120	120	178	238	240	170	
16	2781	2546	2939	3506	4440	388[illegible]	
17	10449	7927	7419	8039	7835	7305	
18	24817	24972	22645	20987	20931		
19	57	49	898	4256	8697	4665	
20	82	66	155	646	1438	523	
21							
22							
23							
24			139	1283	4967	120	
25	40			52	96		
26		63	148	174	287	118	
27	159	195	390	601	1236		
28	1261[illegible]	12588	18349	24824	39385	2123[illegible]	
29	[illegible]7	83	142		336	[illegible]	
30	473	505	795	72[illegible]1		976	
31			15248		100919	10036	
32	3511	3196	3490	4805	7232	3446	
33				40		124	
34							
35							
36							
37							
38							
39							
40	972	996	1819	3173	5845	1917	
41					50	40	
42					47	158	
43			349	1253	34[illegible]		
44	413	408	1238	2047	4425	6855	
45					54		
46			40				
47				117	239	389	
48							
49							
50			3313	24139	66834	3124	
51			46	185	586	63	
52							
53							
54							
55			[illegible]	79	81		
56							
57							
58							
[illegible]							
[illegible]							
[illegible]							
[illegible]			323	894	2331	[illegible]	
[illegible]							
64							
65			77	57	46		
66					65		
[illegible]							
[illegible]					46		
[illegible]			[illegible]50	7759	10696		
[illegible]			44		47		
[illegible]							
[illegible]							
[illegible]							
[illegible]			77	33	82		
[illegible]							
[illegible]							
[illegible]							
[illegible]							
79							
80							
81			4182		73934	439[illegible]	
82			48		1222	[illegible]	
83							
84							
85			59		1787	676[illegible]	
86					49	[illegible]57	
87						87	
88							
[illegible]							
90							
91							
92							

Teflon Tubing, FEP

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	300	475	550	625	700	
93			142		117		
94							
[illegible]							
[illegible]							
97							
[illegible]							
[illegible]							
[illegible]			[illegible]	9581	16145	[illegible]	
101					124		
[illegible]							
[illegible]							
[illegible]							
[illegible]							
106							
[illegible]							
108							
[illegible]							
[illegible]							
111							
[illegible]							
113							
114							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
119							
[illegible]							
121							
[illegible]							
123							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
131			79	55			
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
161							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
[illegible]							
171							

Diall FS-80, Black, Mil-P-19833 Type GDI-30

Chemical Characterization Summary

Mix ratio: As received
Cure: As received

1. Isothermal Weight loss in Nitrogen: 0.55%

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: 24 hr min at 23°C (296°K) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 25°C-320°C (298°K-593°K)

a_o = 7% of initial weight

$$k = 6.3 \times 10^{10} \exp\left(\frac{-31900}{1.98\ T^{\circ}K}\right) \ \text{min}^{-1}$$

In Nitrogen:

Over the range:

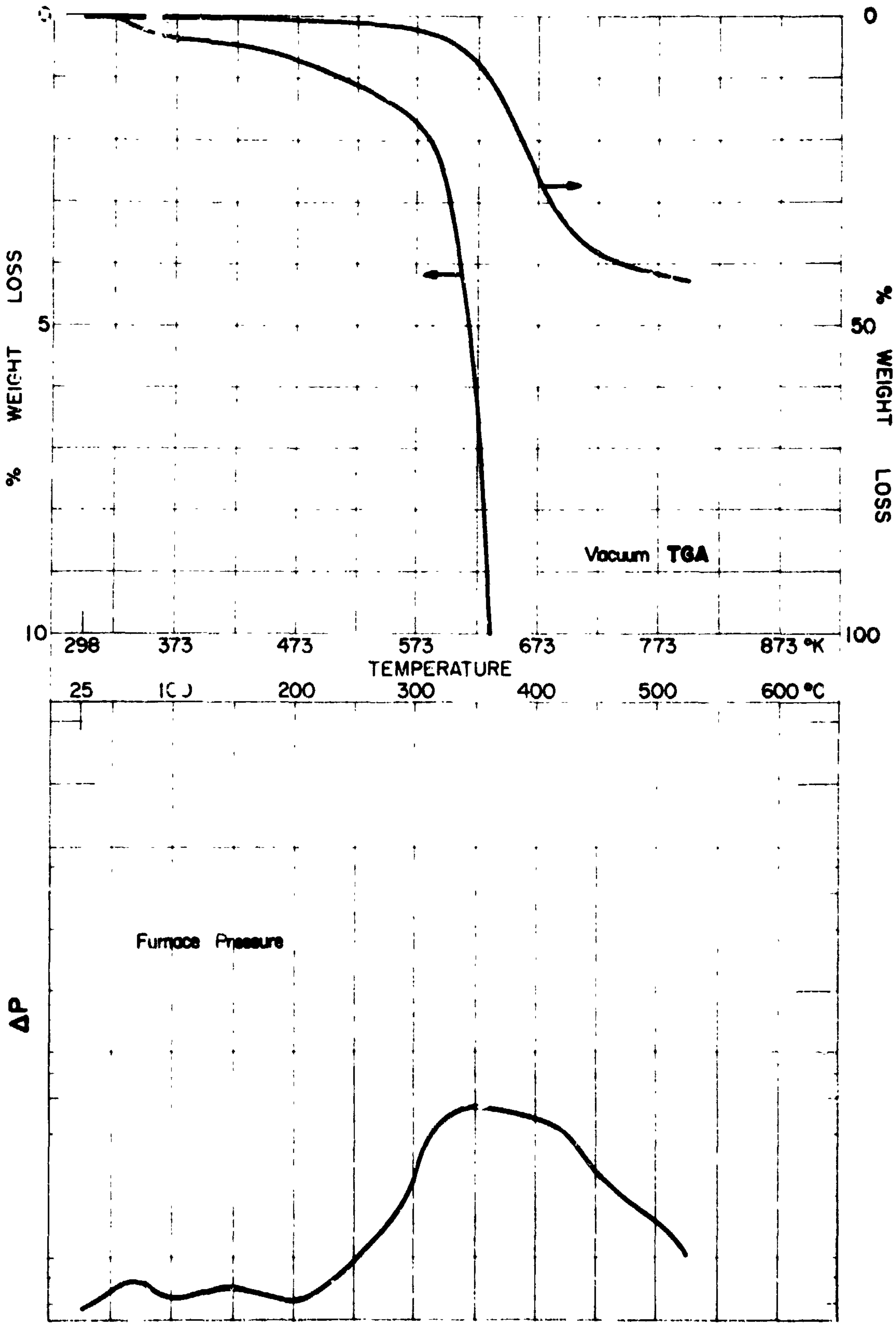
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{\circ}K}\right) \ \text{min}^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	4.5×10^{10}	
100°C (373°K)	5.6×10^{7}	
150°C (423°K)	3.2×10^{5}	

Dixll FS-80, Black Mil-P-19833 Type COI-30



C-4 M2

Diall FS-80, Black Mil---19833 Type G01-30

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	200	325	400	450	575	
14	2256	2235	5100	3109	2900	2645	
15	832	1262	7008	3968	3963	3940	
16	5712	5555	12809	10802	8906	9680	
17	22170	19547	32782	25034	18617	16732	
18	73148	64441	100740	81547	58767	52545	
19	1142	1059	1082	816	622	593	
20	753	568	1253	1173	805	724	
21							
22			194				
23							
24			318	251	38		
25	62	42	1547	1393	843	118	
26	374	659	7517	7137	5016	1281	
27	658	100[illegible]	7211	8655	7109	1250	
28	25229	25498	55007	49015	38517	29066	
29	41[illegible]	746	8866	5458	5155	652	
30	554	497	1402	1207	1275	597	
31	242	479	2200	534	334	139	
32	6271	5983	6088	5797	5537	5200	
33							
34							
35			1179	1003	237		
36			5491	5236	1826	570	
37			2920	1791	816	102	
38		76	4667	3991	1891	424	
39	[illegible]	654	5786	9919	6989	899	
40	3961	4056	7034	7367	6064	4391	
41	82	707	6418	8552	6300	313	
42	97	139	4439	2979	2532	51	
43	130	1190	11698	3074	2887	197	
44	1484	1907	42820	23132	11231	8093	
45	91	67	7121	1209	489	128	
46			152	43			
47							
48			74				
49			1236	753	251		
50		92	7931	4914	2271	764	
51		78	1816	5598	2688	879	
52			1071	1783	821	383	
53			1071	2494	1731		
54			1178	714	401		
55			1550	3232	3269		
56		130	1255				
57		102	1452	919	926		
58		110	1607	150	85		
59		379					
60			2034	205			
61			610	172			
62			249	444	181		
63			327	1344	647	69	
64				319	107		
65	64		448	1769	894		
66	67	40	498	597	248		
67			513	2565	1645		
68			244	837	664		
69			88	786	379		
70			141	545	667		
71				98	119		
72							
73			664	177			
74			2078	894	250		
75			1107	413	80		
76			7811	1479	315		
77			1922	5573	2154	617	
78		125	955	2163	967	1610	
79			126	2107	732		
80				262			
81				783	233		
82				355	60		
83				88	48		
84	103		110	191	139		
85							
86							
87							
88							
89				154	41		
90							
91			236	3872	2009	319	
92				846	485	59	

Diall FS-80, Black Mil-P-19833 Type GDI-30

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	200	325	400	450	575	
93				703	93		
94		175		207			
95				213			
96							
97							
98							
99							
100							
101							
102							
103				218			
104			4935	735	59		
105			1009	3725	1437	91	
106				604	214		
107				198			
108							
109							
110							
111							
112							
113							
114							
115							
116				313	79		
117							
118				230			
119				48			
120				422	153		
121				163			
122			71				
123				766	112		
124							
125							
126							
127							
128							
129	86			118			
130							
131	51						
132	81			40			
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Dial' FS-80, Black, Mil-P-19833 Type GOI-30

Table 1. Flexure Strength (ASTM D790-66)*

Exposure	Average		High		Low		Samples Tested
	psi $\times 10^{-3}$	Pa $\times 10^{-7}$	psi $\times 10^{-3}$	Pa $\times 10^{-7}$	psi $\times 10^{-3}$	Pa $\times 10^{-7}$	
Ambient	13.7	9.4	19.4	13.4	8.8	6.1	4
Heat compatibility (1)	13.0	9.0	17.5	12.1	10.1	7.0	5
One Month Thermal Vacuum (2)	16.3	11.2	21.2	14.6	10.8	77.4	5

* Procedure A, at a speed of 0.02 inch/minute with a 1 inch span using a 0.50 inch wide by 0.073 inch thick specimen.

(1) Heat compatibility - 380 hours at 275°F (408°K) in N_2 atmosphere

(2) Thermal Vacuum - Tested at 1×10^{-5} Torr after heat compatibility (2) followed by 30 days at 150°F (388°K) and 1×10^{-6} Torr.

Diall FS-80, Black, Mil-P-19833 Type GOI-30

Table 2. Dielectric Constant (ASTM D150) @ 1 MHZ

Exposure	Average	High	Low	Samples Tested
Baseline	3.79	3.81	3.78	3
Heat compatibility(1)	3.60	3.69	3.40	3
Heat compatibility(1) plus 30 day thermal vacuum (2)	3.43	3.57	3.33	3

Table 3. Dissipation Factor (ASTM D150) @ 1 MHZ

Baseline	0.012	0.013	0.012	3
Heat compatibility(1)	0.009	0.011	0.007	3
Heat compatibility(1) plus 30 day thermal vacuum (2)	0.002	0.003	0.001	3

Table 4. Volume Resistivity (ASTM D257) @ 1000 VDC

Baseline	1.1×10^{14}	1.2×10^{14}	1.1×10^{14}	3
Heat compatibility(1)	1.25×10^{15}	1.4×10^{15}	1.1×10^{15}	3
Heat compatibility(1) plus 30 day thermal vacuum (2)	4.7×10^{13}	4.9×10^{13}	4.6×10^{13}	3

(1) Heat compatibility - 380 hours at 275°F (408°K) in N_2 atmosphere.

(2) Tested at 1×10^{-5} Torr after exposure for the specified length of time at 150°F (338°K) and 1×10^{-6} Torr.

Chemical Characterization Summary

Mix ratio: As received
Cure: As received

1. Isothermal Weight loss in Nitrogen: 0.0%

2. Steady-State Vacuum Condensible Degassing Rate: 2.084×10^{-5} %/day

3. TGA Conditioning:

   TGA Vacuum: 24 hr at 23°C (296°K) and 45% RH
   Nitrogen:

4. Activation Energy of Decomposition:

   In Vacuum:

   Over the range: 220°C-600°C (473°K-873°K)

   a_o = 34% of initial weight

   $$k = 3.2 \times 10^{6} \exp\left(\frac{-21900}{1.98\ T^{o}K}\right) \min^{-1}$$

   In Nitrogen:

   Over the range:

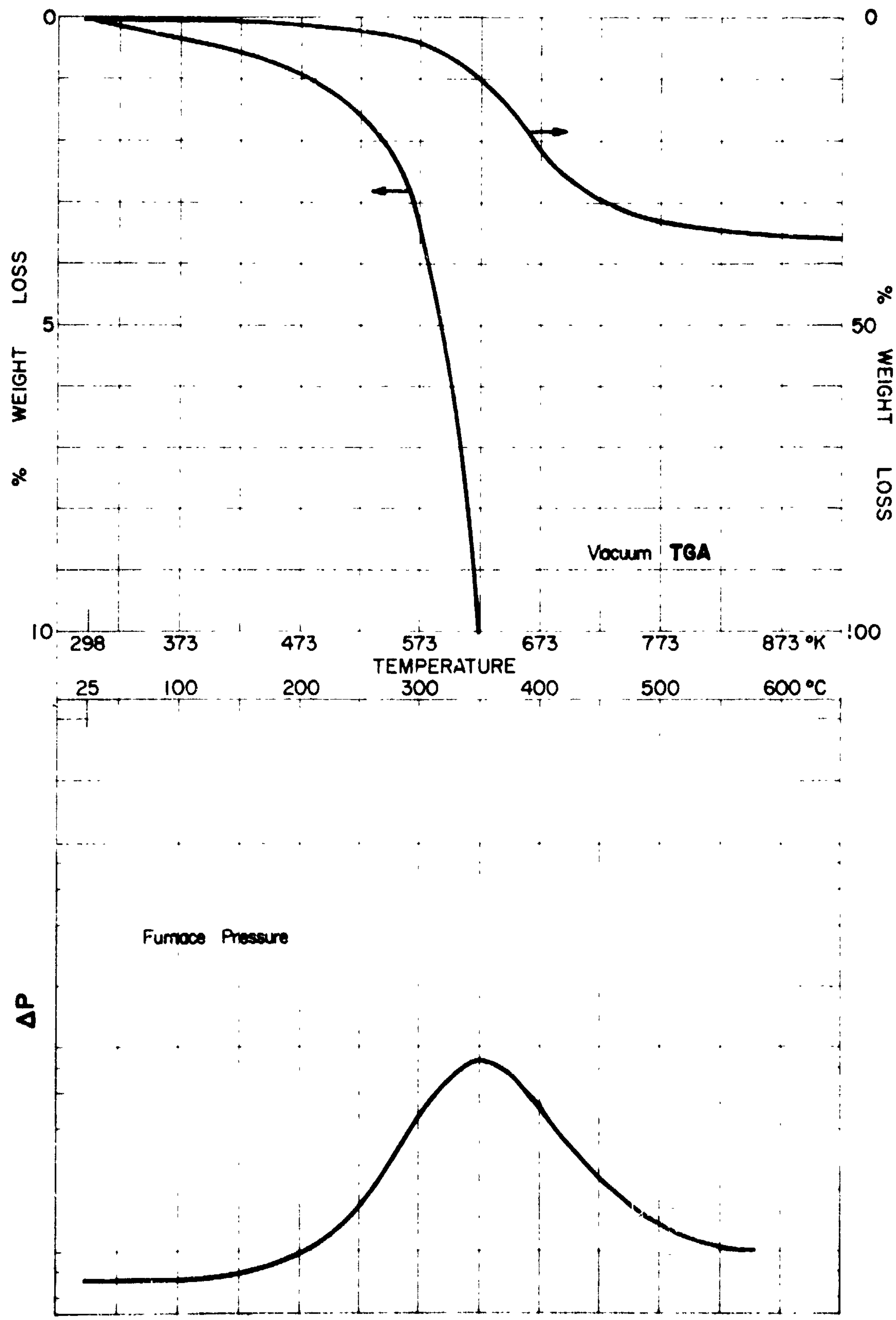
   a_o = of initial weight

   $$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec) In Vac	Time (Sec) In Nitrogen
50°C (323°K)	1.4×10^{8}	
100°C (373°K)	1.4×10^{7}	
150°C (423°K)	5.0×10^{4}	

LubeLok 4306



M8

Label 1306

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, ^{o}C

m/e	25	250	350	450	550		
14	803	1053	3643	1284	1148		
15	142	333	3404	1199	1300		
16	3134	3560	6081	4332	4424		
17	10568	10264	13692	10352	9414		
18	34296	31554	42015	31038	27663		
19	146	165	231	143	96		
20	120	165	324	184	191		
21							
22			46				
23							
24			75	65			
25			265	202	67		
26	71	175	1411	1638	494		
27	214	368	1380	2522	653		
28	12211	15215	33936	17896	15569		
29	93	2842	22446	1556	294		
30	660	2624	13740	1156	947		
31		80	1263	51	99		
32	3367	3222	3904	3071	3115		
33							
34							
35							
36			40				
37			94	136	55		
38			197	265	98		
39		52	978	2032	436		
40	1165	1232	2046	2062	1584		
41		57	1033	1659	106		
42		74	1549	737	68		
43	45	151	4058	1040	113		
44	439	1458	9594	1642	1004		
45		63	3440	106	51		
46			719	55			
47		41					
48			49	52			
49			54				
50			229	350	166		
51			212	406	203		
52				162	74		
53			104	258	58		
54			57	116			
55			106	479			
56			48	206			
57				116			
58			48	48			
59							
60			1094	43			
61							
62				70			
63			60	140	96		
64		6	46	56			
65			86	255	120		
66			79	156	64		
67			63	282			
68			47	74			
69			44	77			
70			83	63			
71							
72							
73							
74				42			
75							
76							
77			138	280	110		
78		76	228	129	105		
79			69	272	49		
80				62			
81				76	41		
82							
83							
84							
85							
86							
87							
88							
89				45			
90							
91			61	302	390		
92				59	141		

MQ

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	250	350	450	550		
93				45			
94			55	94	52		
95				40			
96							
97							
98							
99							
100							
101							
102							
103							
104							
105				53			
106							
107				94			
108				40			
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: As received
Cure: As received

1. Isothermal Weight loss in Nitrogen: 1.07%

2. Steady-State Vacuum Condensible Degassing Rate: 9.068×10^{-6} %/day

3. TGA Conditioning:

TGA Vacuum: 100 hr at 125°C (398°K) in N_2 atmosphere
Nitrogen: 24 hr at 23°C (296°K) and 45% RH

4. Activation Energy of Decomposition:

In Vacuum: Not amenable to analysis

Over the range:

a_o = of initial weight

$$k = \exp\left(\frac{-}{1.98\ T^{o}K}\right) \ \text{min}^{-1}$$

In Nitrogen:

Over the range: 300°C-750°C (573°K-1023°K)

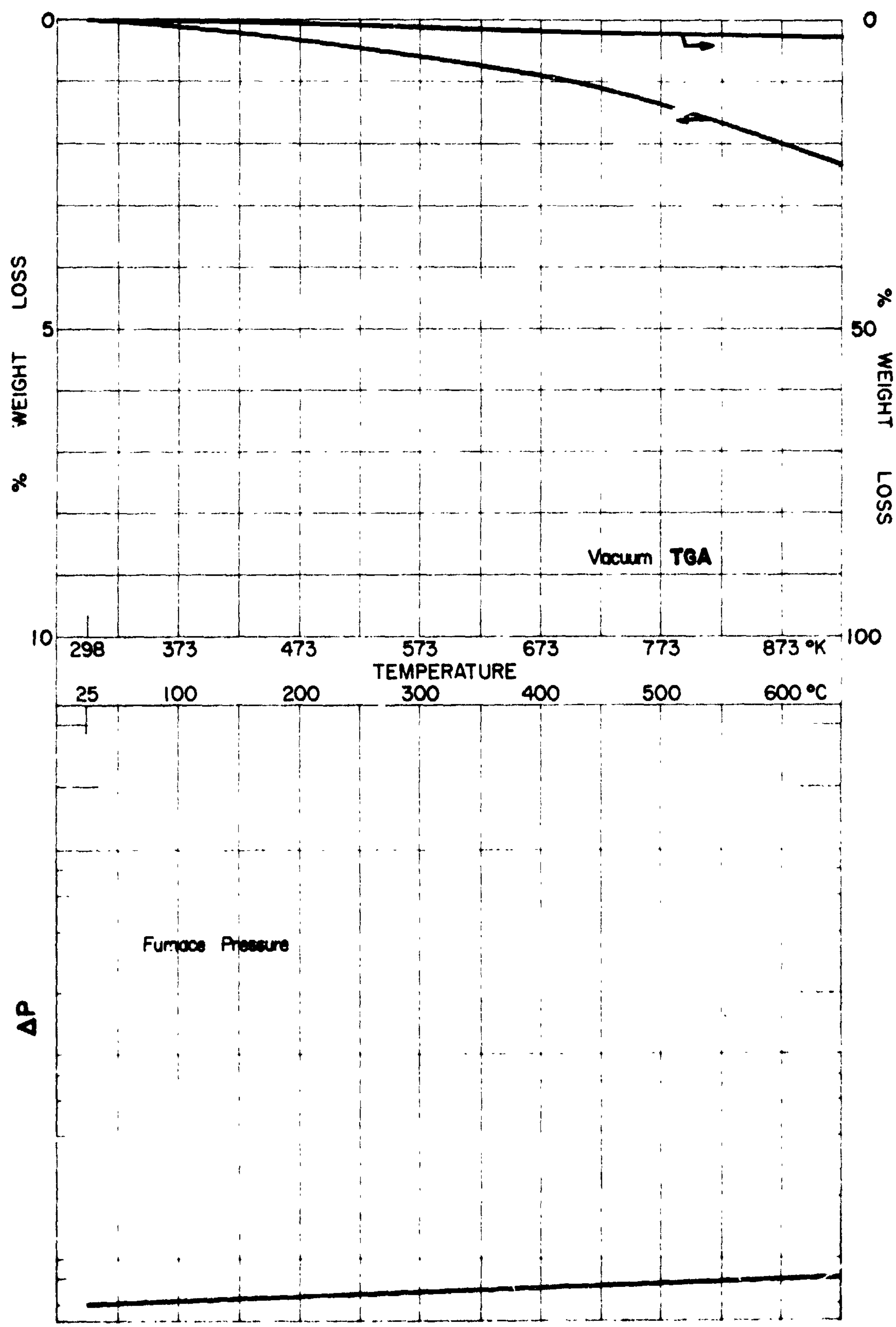
a_o = 5% of initial weight

$$k = 13 \exp\left(\frac{-\ 7620}{1.98\ T^{o}K}\right) \ \text{min}^{-1}$$

Time to 1% Weight Loss at Temperature T

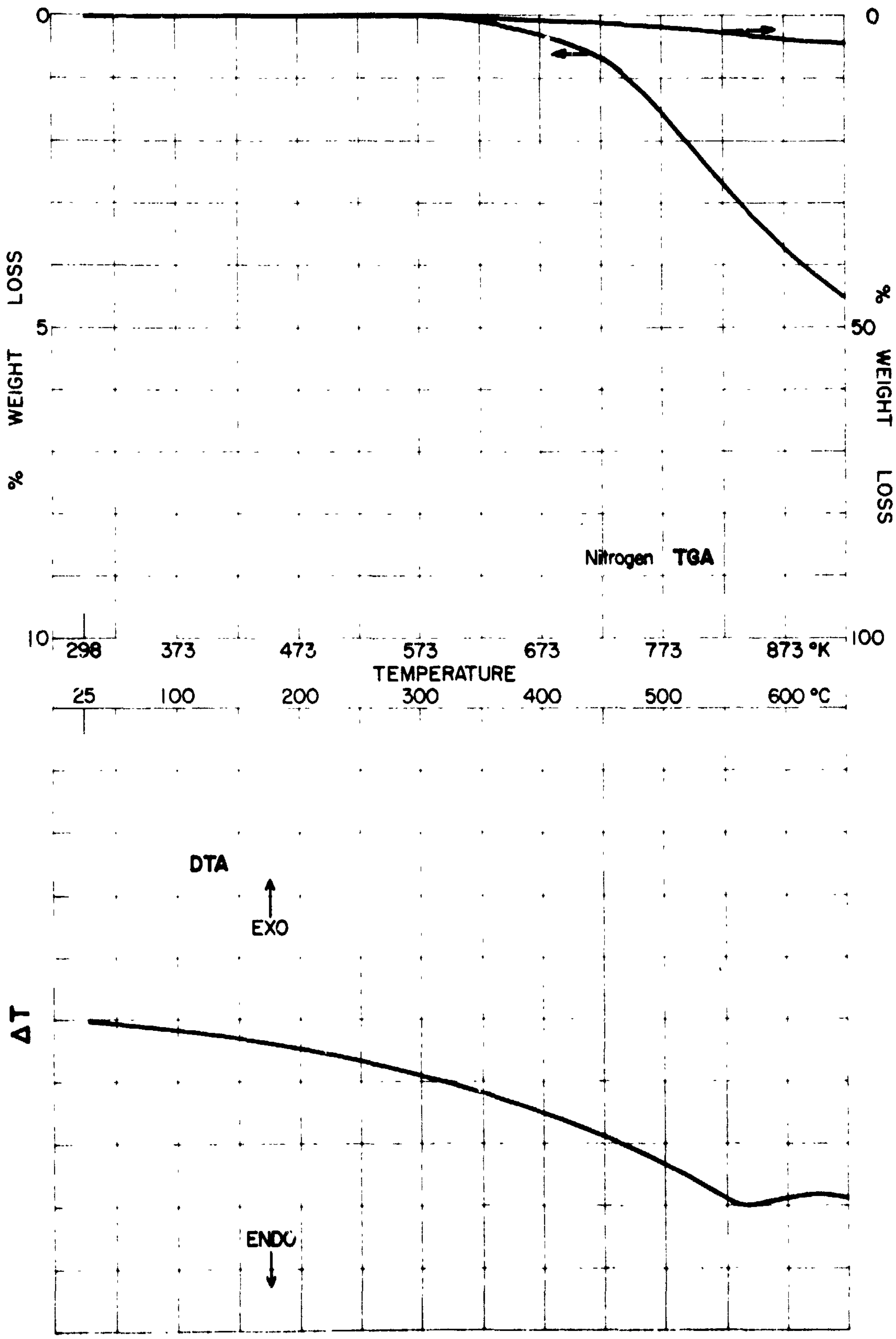
Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)		7.1×10^3
100°C (373°K)		1.4×10^3
150°C (423°K)		4.2×10^2

Min-K-2000



M12

Min-K-2000



% WEIGHT LOSS
0
5
10
0
50
100
% WEIGHT LOSS
Nitrogen TGA
298
373
473
573
673
773
873 °K
TEMPERATURE
25
100
200
300
400
500
600 °C
DTA
EXO
ΔT
ENDO

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	200	400	600	700		
14	442	473	511	574	566		
15	89	102	117	204	259		
16	2612	2494	2725	2871	2956		
17	9408	8200	8080	7960	7436		
18	31292	26102	25432	24330	23014		
19							
20	69	72	56	71	63		
21							
22							
23							
24							
25			46				
26	47	54	74	114	141		
27	88	113	144	163	273		
28	8997	9098	9571	10675	10859		
29	55	59	76	97	111		
30	404	459	508	519	538		
31							
32	2619	2545	2647	2647	2624		
33							
34							
35							
36							
37							
38							
39				52	56		
40	495	502	666	629	708		
41					49		
42							
43					44		
44	243	243	295	356	549		
45							
46							
47							
48							
49							
50							
51							
52							
53							
54							
55							
56							
57							
58							
59							
60							
61							
62							
63							
64							
65							
66							
67							
68							
69							
70							
71							
72							
73							
74							
75							
76							
77							
78							
79							
80							
81							
82							
83							
84							
85							
86							
87							
88							
89							
90							
91							
92							

Table 1. Dimensional Stability (ASTM C548)

Specimen	Before Exposure			After Heat Compatibility (1) and Thermal Vacuum (2)		
	Length	Width	Thickness	Length	Width	Thickness
1	10.95 in.	2.97 in.	1.48 in.	10.96 in.	2.97 in.	1.48 in.
2	11.00	2.95	1.48	11.00	2.98	1.47
3	9.95	3.00	1.48	9.95	2.99	1.47

(1) Heat compatibility: 383 hours @ 275°F (408°K)

(2) Thermal vacuum: nine weeks @ 150°F (338°K) at 1×10^{-6} Torr

Table 2. Soaking Heat (ASTM C356)

	Before Exposure	After Exposure (1)
Length	11.0 in.	10.94 in.
Width	2.98	2.94
Thickness	1.47	1.44
Weight	247.0 gm	234.5 gm

(1) Exposure: 28 min. in. N_2 at 1780°F (1243°K)

Table 3. Thermal Conductivity* (ASTM C177)

	Btu-in./hr/ft^2/°F
Control (air)	0.197
Test (10 Torr O_2)	0.062

* at 275°F (408°K)

Table + . Compressive Strength (ASTM C165)

Exposure	% Compression	Load					
		Average		High		Low	
		psi	Pax10^{-3}	psi	Pax10^{-3}	psi	Pax10^{-3}
Baseline	1	0.22	1.5	.25	1.7	.17	1.2
	2	1.33	9.2	1.42	9.8	1.19	8.2
	3	7.33	50.5	7.92	54.6	5.83	40.2
	4	23.3	160.6	25.0	173.4	20.3	140.0
	5	42.2	290.9	46.1	317.8	40.0	275.8
Heat Compatibility (1) Plus Thermal Vacuum (2)	1	0.22	1.5	0.28	1.9	0.17	1.2
	2	1.25	8.6	1.81	12.5	0.83	5.7
	3	7.18	49.5	12.5	86.2	4.44	30.6
	4	25.2	173.7	35.3	243.4	17.4	120.0
	5	50.5	348.2	55.5	382.7	38.1	262.7

(1) Heat compatability - 383 hours at 275^{o}F (408^{o}K)

(2) Thermal Vacuum - 30 days @ 150^{o}F (338^{o}K) at 1x10^{-6} Torr

Chemical Characterization Summary

Mix ratio: As Received
Cure: As Received

1. Isothermal Weight loss in Nitrogen:

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: None (Room Ambient)
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: 325°C-410°C (598°K-683°K)

a_o = 13% of initial weight

$$k = 2.1 \times 10^{23} \exp\left(\frac{-72000}{1.98\ T^{o}K}\right) \ \text{min}^{-1}$$

In Nitrogen:

Over the range:

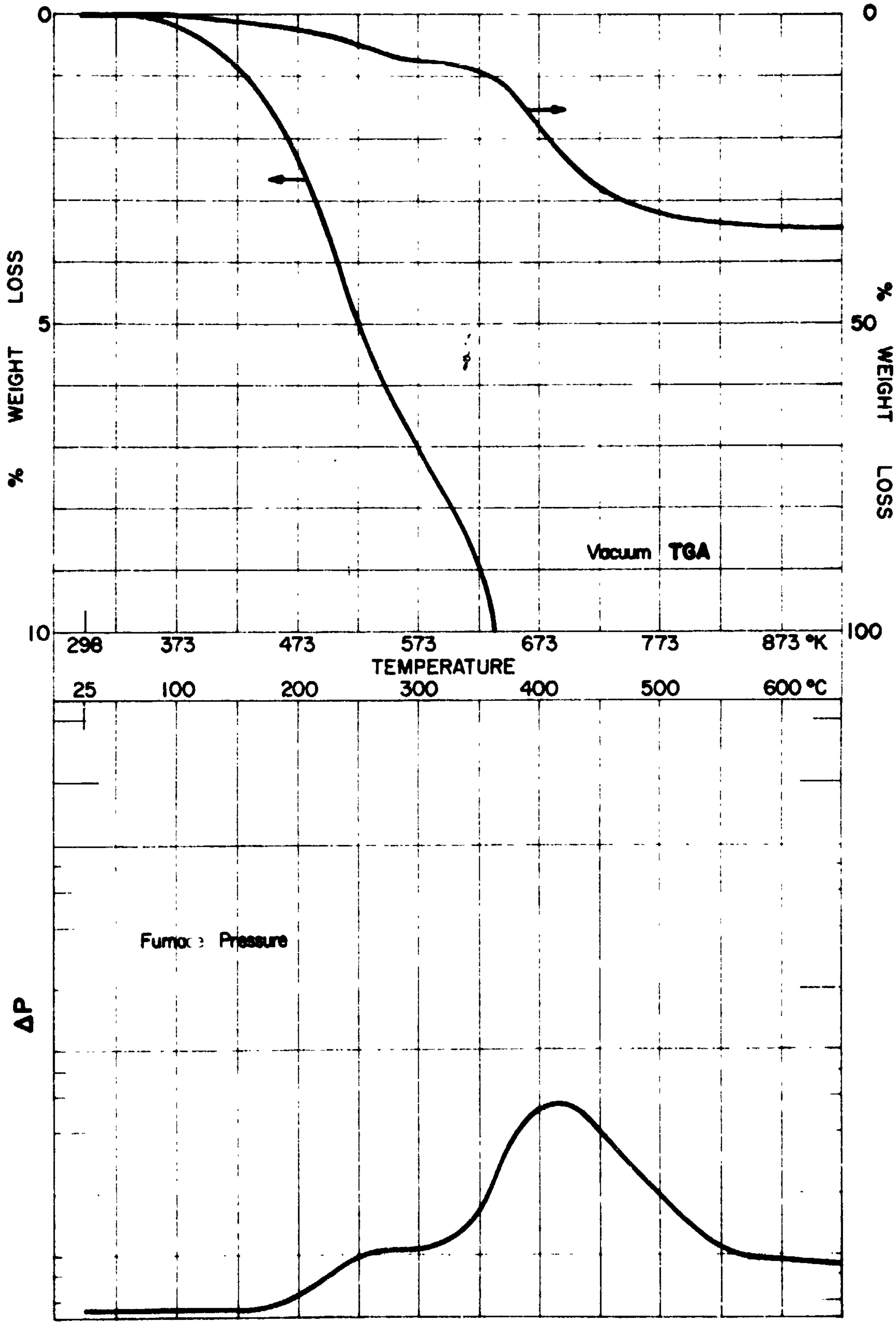
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \ \text{min}^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
50°C (323°K)	2.5×10^{25}	
100°C (373°K)	6.7×10^{18}	
150°C (423°K)	5.9×10^{13}	

P292 Tape



M18

Tape P292

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	200	375	425	550		
14	2204	2162	3769	5285	3239		
15	817	1044	5752	10023	4700		
16	4752	4533	6317	8264	7226		
17	17438	14706	12422	12458	12001		
18	57901	48263	40119	39133	36997		
19	479	534	586	533	581		
20	467	471	467	470	438		
21							
22							
23							
24			192	323	49		
25	44	88	746	1210	236		
26	422	646	3533	5559	1485		
27	513	681	1859	2887	1114		
28	27118	26860	32433	36038	29468		
29	366	525	1461	2393	890		
30	363	395	567	634	422		
31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		
32		5623	5089	5425	5194		
33							
34							
35							
36	48	62	96	129	106		
37			63	94			
38		60	124	215	62		
39		145	436	694	227		
40	3569	3570	4009	4676	3767		
41	77	136	336	611	191		
42	62	126	334	627	203		
43	79	289	961	2484	604		
44	696	881	1145	1700	936		
45		785	3277	7796	1335		
46		44	158	447	46		
47		237	531	794	146		
48							
49							
50		46	68	117	46		
51			203	524	143		
52			365	1320	320		
53			76	223	41		
54							
55			139	314	75		
56			42	87			
57			137	401	62		
58			177	619	81		
59		54	2057	5920	909		
60			163	476	43		
61			509	945	82		
62							
63			41	45			
64				57			
65			53	65			
66	55	54	883	3416	914		
67			137	550	96		
68							
69				47			
70				51			
71			105	373			
72			15252		78		
73				38365	3279		
74			1300	3227	244		
75		1849	3055	3910	534		
76		81	164	192			
77		75	228	266	178		
78			91	124	83		
79							
80				59			
81			220	300			
82			121	200			
83			47	87			
84	105	89	137	141	100		
85			93	278			
86			48	116			
87			436	1027	99		
88			140	362			
89			386	599	43		
90				46			
91			48	86			
92							

Tape P292

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	200	375	425	550		
93							
94							
95			47	168			
96			2358	2574	309		
97				272			
98							
99							
100							
101				151			
102			65	181			
103			654	1535	115		
104			112	208			
105			167	372			
106							
107							
108							
109							
110							
111							
112							
113							
114							
115			238	433			
116				53			
117			172	543			
118			49	67			
119			370	513			
120				40			
121							
122							
123							
124							
125			44				
126							
127							
128							
129	101	97	125	148	87		
130							
131	59	56	215	634	130		
132	86	83	135	223	85		
133			979	1395	111		
134			109	199			
135			41	58			
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147			1525	5097	905		
148			158	699	76		
149			93	329			
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: As received film
Cure: As received

1. Isothermal Weight loss in Nitrogen: 0%

2. Steady-State Vacuum Condensible Degassing Rate:

3. TGA Conditioning:

TGA Vacuum: None (Room Ambient)
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: $25^{\circ}C-240^{\circ}C$ ($298^{\circ}K-513^{\circ}K$)

a_o = 2% of initial weight

$$k = 3x10^{19} \quad \exp\left(\frac{-20200}{1.98\ T^{\circ}K}\right) \quad min^{-1}$$

In Nitrogen:

Over the range:

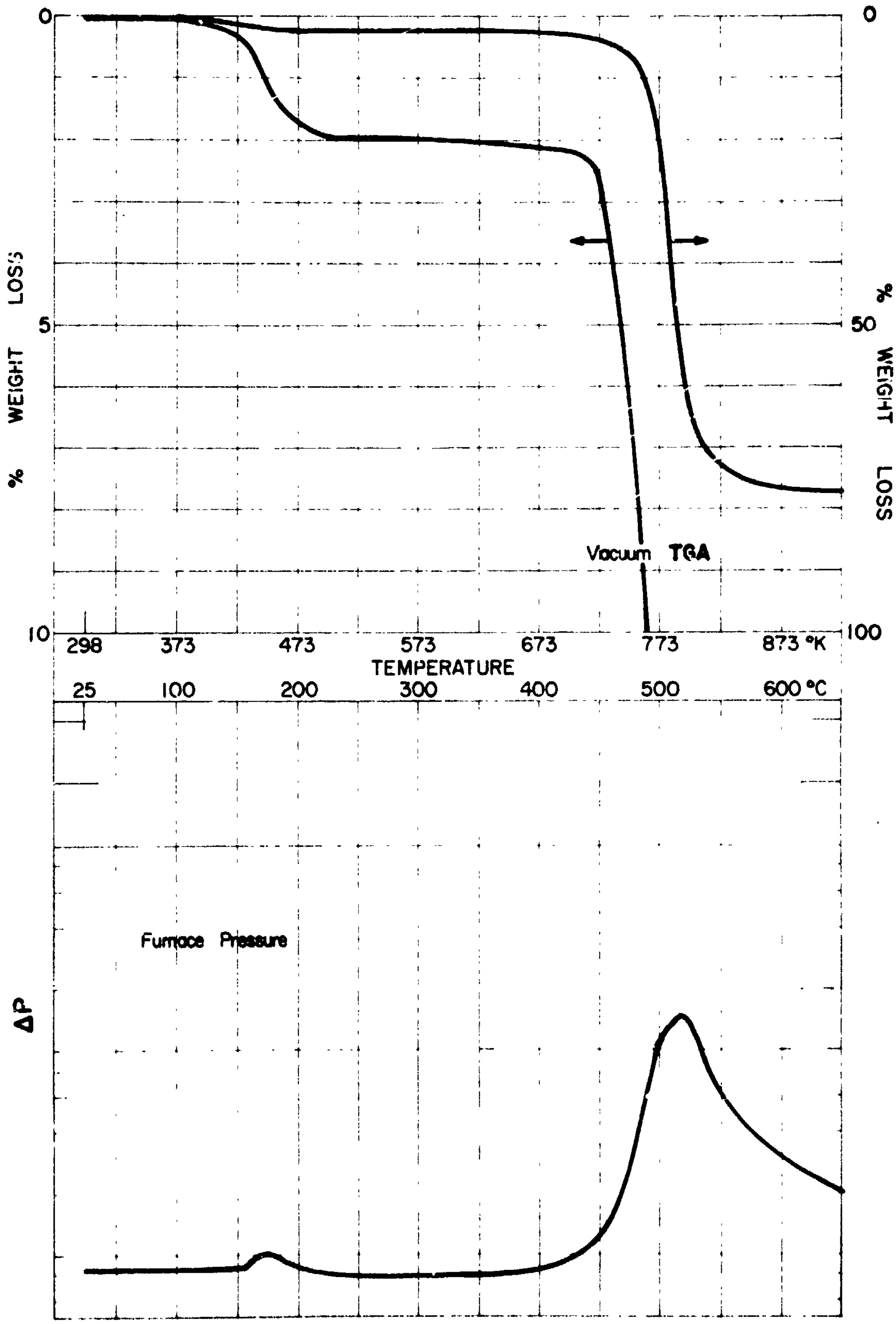
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{\circ}K}\right) \quad min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
$50^{\circ}C$ ($323^{\circ}K$)	$1.1x10^4$	
$100^{\circ}C$ ($373^{\circ}K$)	$1.5x10^2$	
$150^{\circ}C$ ($423^{\circ}K$)	6	

Parylene C



M22

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	150	300	475	511	550	650
14	1108	995	1007	1226	1703	1596	1781
15	299	356	337	1156	3751	3029	4213
16	3910	3794	3624	4487	6319	6377	7922
17	14370	12656	12028	12211	12653	11861	11958
18	47324	41094	38314	38699	38968	36400	36799
19	122	104	114	160	227	161	115
20	4	164	138	389	748	519	276
21							
22							
23							
24					145	55	
25	41	45	42	112	674	257	92
26	144	231	224	860	4176	1762	616
27	485	483	578	1121	5385	1998	945
28	15036	15322	15547	18255	18778	17220	17190
29	1063	1194	1303	1477	1713	1597	1512
30	1343	1342	1432	1510	1657	1700	1585
31	493	571	799	982	1156	1148	1346
32	3681	3543	3609	3704	3690	3476	3527
33							
34							
35				986	8268	3696	364
36			41	5520	37612	18380	2617
37				291	3298	1273	126
38				1683	13266	6008	774
39		40	41	367	5809	1357	199
40	1499	1449	1580	1736	2649	2008	1737
41	40	49	53	81	418	156	81
42		61	55	83	139	102	80
43	155	148	175	342	649	506	388
44	759	791	685	946	1116	726	719
45	149	131	196	273	567	506	411
46	53	68	85	111	135	127	133
47					63		
48					87	47	43
49				51			
50				236			
51			42	686	9773	1443	186
52				95	1788	245	68
53				59	983	122	
54					53		
55					51		
56							
57					80		
58					120		
59					46		
60					152	59	
61				56	635	80	
62				71	1553	232	
63				190	3666	635	72
64				45	517	109	62
65				81	1106	311	53
66					82	40	
67							
68					64		
69					228		
70					124		
71							
72					45		
73				51	558	63	41
74				46	906	114	
75				62	1169	97	40
76					538	74	
77				[illegible]	5939	752	148
78				92	2086	206	155
79				116	2142	170	
80					86		
81							
82							
83							
84					53		
85					94		
86					157	40	
87					146		
88					52		
89				58	720	104	
90					143	56	
91				107	2169	1482	89
92					109	141	

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	150	300	475	511	550	650
93							
94							
95							
96							
97							
98					44		
99					68		
100							
101					67		
102					211		
103				71	1251	71	
104					360	4[illegible]	
105				414	6657	492	54
106					494	66	
107							
108							
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125					67		
126							
127							
128							
129							
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							

Chemical Characterization Summary

Mix ratio: As Received
Cure: As received

1. Isothermal Weight loss in Nitrogen: 0.005%

2. Steady-State Vacuum Condensible Degassing Rate: 8.2×10^{-5} %/day

3. TGA Conditioning:

TGA Vacuum: 24 hr at $23^{o}C$ ($296^{o}K$) and 45% RH
Nitrogen:

4. Activation Energy of Decomposition:

In Vacuum:

Over the range: $50^{o}C-510^{o}C$ ($323^{o}K-783^{o}K$)

a_o = 25% of initial weight

$$k = 4.3\times10^{9} \exp\left(\frac{-33900}{1.98\ T^{o}K}\right) \min^{-1}$$

In Nitrogen:

Over the range:

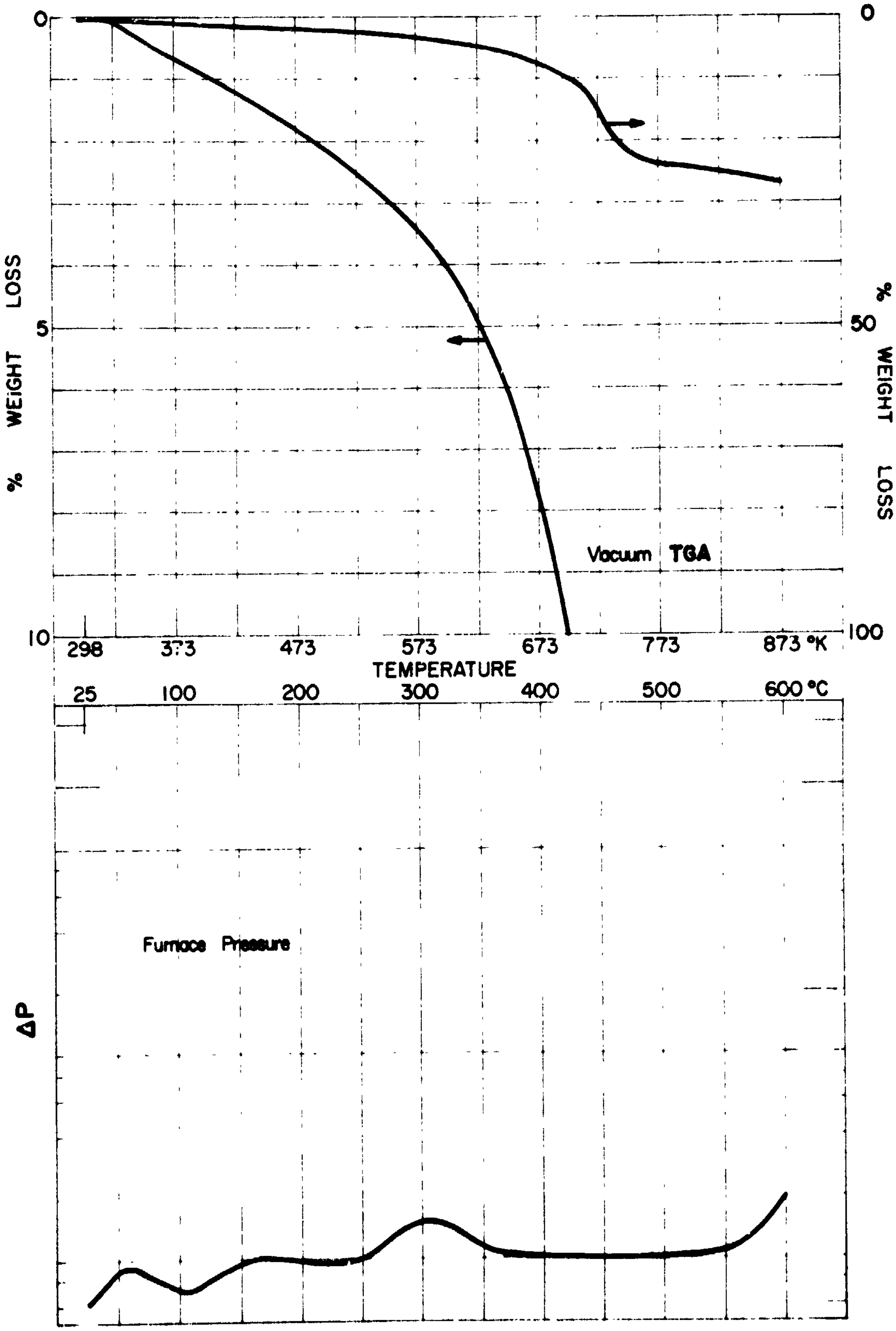
a_o = of initial weight

$$k = \quad \exp\left(\frac{-}{1.98\ T^{o}K}\right) \min^{-1}$$

Time to 1% Weight Loss at Temperature T

Temp	Time (Sec)	
	In Vac	In Nitrogen
$50^{o}C$ ($323^{o}K$)	1.5×10^{13}	
$100^{o}C$ ($373^{o}K$)	1.2×10^{10}	
$150^{o}C$ ($423^{o}K$)	5.2×10^{7}	

Vac Kote Type II



M26

MASS NUMBER AND RELATIVE PEAK INTENSITY

TEMPERATURE, °C

m/e	25	200	350	450	550		
14	2007	2017	2128	2010	2004		
15	368	477	728	641	574		
16	3207	3427	3497	3858	4138		
17	11199	11017	10483	10123	9840		
18	36066	35142	32905	31607	30063		
19	134	110	127	112	113		
20	111	93	150	123	105		
21							
22				45	42		
23							
24							
25	66	75	132	126	123		
26	378	535	817	795	863		
27							
28	19972	20084	20983	21531	28479		
29	293	494	1036	662	546		
30	652	688	960	778	787		
31	73	112	535	4101	70		
32	4486	4298	4259		4016		
33							
34							
35			62				
36			309	53	43		
37			54	41	44		
38			119	64	53		
39	68	100	234	298	167		
40	694	650	723	717	772		
41	59	154	271	333	136		
42	47	71	206	159	99		
43	78	177	565				
44	467	856	2665	4697	5067		
45			188	70	65		
46			50				
47							
48			57				
49							
50	41	51	88	98	128		
51		43	80	83	119		
52			40	40	55		
53				44			
54							
55		45	110	85			
56		59	63	65			
57			67	70			
58							
59							
60							
61							
62							
63							
64			87	70			
65			44	48	48		
66		43	47	54	50		
67				47			
68							
69							
70							
71							
72							
73							
74							
75							
76							
77			62	53	64		
78				40	80		
79							
80							
81							
82							
83							
84	45	44	46	45	50		
85							
86							
87							
88							
89							
90							
91				69			
92							

Vac-Kote Type II

MASS NUMBER AND RELATIVE PEAK INTENSITY (Cont)

TEMPERATURE, °C

m/e	25	200	350	450	550		
93							
94							
95							
96							
97							
98							
99							
100							
101							
102							
103					42		
104					43		
105							
106							
107							
108							
109							
110							
111							
112							
113							
114							
115							
116							
117							
118							
119							
120							
121							
122							
123							
124							
125							
126							
127							
128							
129				42	40		
130							
131							
132							
133							
134							
135							
136							
137							
138							
139							
140							
141							
142							
143							
144							
145							
146							
147							
148							
149							
150							
151							
152							
153							
154							
155							
156							
157							
158							
159							
160							
161							
162							
163							
164							
165							
166							
167							
168							
169							
170							
171							